AMERICAN ENGINEER AND RAILROAD JOURNAL.

NOVEMBER, 1901.

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AMERICAN ENGINEER TESTS.

Locomotive Draft Appliances.

II.

THE THEORIES TO BE INVESTIGATED.

A Research by H. H. Vaughan.

Member A. S. M. E.

An examination of the Hanover or Von Troske experiments discloses that they were directed almost exclusively to ascertaining the efficiency of various forms and sizes of stacks when used with nozzles of different sizes at varying distances from the stack. A few series of tests were made at different steam pressures, but as these led to the conclusion that within the limits of practical working the vacuum obtained varied directly as the pressure, all succeeding tests were made with a pressure of steam in the blast pipe of 3.94 inches of mercury; this pressure was also constant, that is to say, it was taken for granted that the action of the steam when issuing from the cylinders gave the same results as a steady jet, an assumption that was proved to be substantially correct in the experiments of the Master Mechanics' Association. It is evident, that, supposing it to be true for all forms of stacks that the vacuum varies directly as the pressure, the combination that is most efficient for any one pressure is also most efficient for all, so that in that respect the tests are complete. There is, however, another point that might have been attended to, the area through which the air was allowed to flow into the apparatus.

This was kept constant at 80.72 sq. ins., the size of the opening being determined by adjusting it until a certain combination of stack and nozzle gave the same vacuum on the apparatus, as it had been found to do previously on a locomotive. Now while this is satisfactory for that particular case, it does not appear to follow that the most efficient combination with this area would also be so for a larger or smaller area, in other words, the best combination for one size of engine is not necessarily the best for one that is larger or smaller and it is not possible from these experiments to deduce any results were this condition varied. Experiments were also carried out to determine the advantages or otherwise of bridges in the nozzles and the form of the jet, but none that related in any way to the form of the exhaust passages below the nozzle.

In the experiments of the Master Mechanics' Association, on the other hand, only three stacks were used, and in most of the tests but one size of nozzle. The most advantageous position of this nozzle with reference to the stack was fully determined and the results obtained were confirmed for other sizes of nozzles. A number of tests were devoted to the details of the exhaust pipe; height of bridge, size of choke and form of nozzle and in these respects the results are practically final. The double nozzle, petticoat pipes, bridges in nozzles, and form of the steam jet were also experimented on, but not so completely as the other mentioned points.

In general then the two series of experiments have obtained results more or less definite as follows:

Hanover.	Master Mechanics' Association.
Varying stack with varying nozzles at varying distances, constant pressure.	Three stacks with constant nozzles at varying distance.
Effect of nozzle bridge.	Effect of nozzle bridge.
Form of jet.	Form of jet, etc.
Effect of variation of pressure.	Action of jet.
	Detail design of exhaust pipe.
	Double nozzles.
	Petticoat pipe.

It is safe to assume that as far as the Master Mechanics' experiments go they are absolutely reliable, if they are not we might as well stop at once, but for several reasons that have previously been mentioned the same cannot be said of the Hanover tests. The fact of checking up a few isolated results in practice is not sufficient to establish the truth of all other results, which may or may not be universally true, especially as the service tests so far as can be learned from the report simply showed whether stacks which had given certain results on the testing apparatus, did or did not assist in the steaming qualities of an engine. If results of several series of experiments on the test apparatus had been repeated under identical conditions in the front end of an engine and had been proven substantially true, there would be some foundation for the acceptance of all the results, but in the absence of such a verification they must, as they stand in the report, be open to question.

It is unfortunate, in many respects, that the two series of experiments are to a large extent supplemental. Work done in Hanover was only in a few instances repeated at Chicago, and even in these instances the similarity is not complete. Had the Master Mechanics' experiments been conducted with a steady jet in place of on a running engine it would have been possible to compare the vacuum obtained on the assumption that it varies as the pressure in the exhaust pipe, allowing for the area through which air could flow to the front end, but as this was not done the only comparison possible is that of the general forms of the curves obtained.

In Figs. 1, 2, 3 and 4 the results of the Hanover and Master Mechanics' experiments are shown for three series of tests in which the conditions were very nearly alike. Figs. 1 and 2 show results with 4¾-in. nozzle in both cases, the 14-in. choke stack of the Master Mechanics' Association and the 13.78-in., 1 in 12 in. conical stack of the Hanover tests. The Master Mechanics' Association stack was 52 ins. high, 12 ins. to choke, taper 1 in 11.4, the Hanover stack was 57½ ins. high, 17½ ins. to choke, taper 1 in 12, the length in both cases from choke to top of stack thus being the same, so that the stacks are practically alike. The results of the Hanover tests are compared with series A, B, C, D, E, of the Master Mechanics' Association in Fig. 1 and with series F, G, H, I in Fig. 2. Now there is no question but that in Fig. 1 the Master Mechanics' Association tests show a continued improvement up to a nozzle distance of 43 to 47 ins. in Fig. 1, and up to 45 ins. in Fig. 2, although it is true that the improvement after 30 to 35 ins. is small, while the Hanover tests show a decided and comparatively rapid drop when the nozzle distance is increased over 35 ins. The Master Mechanics' Association results are plotted direct from the

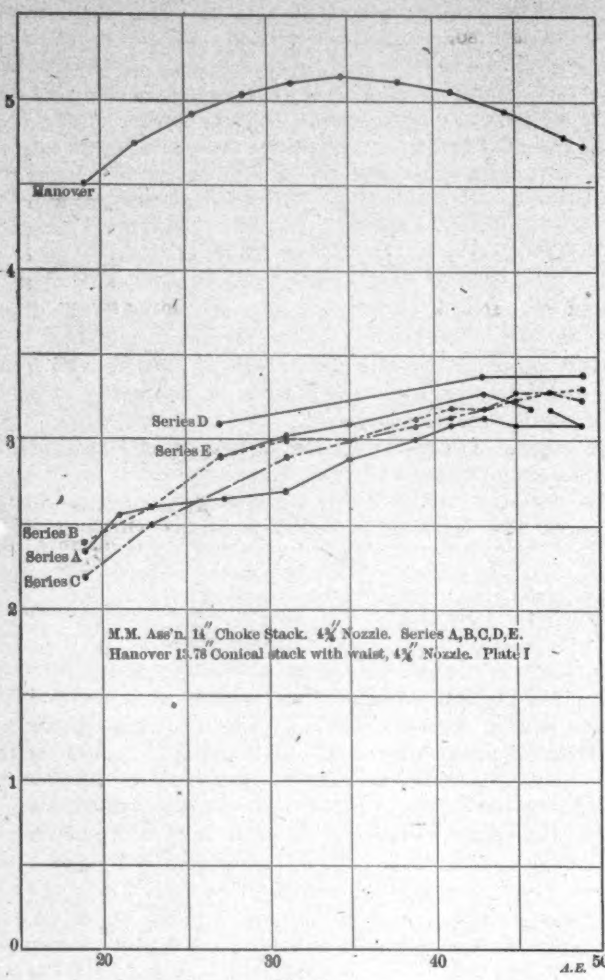

Fig. 1.

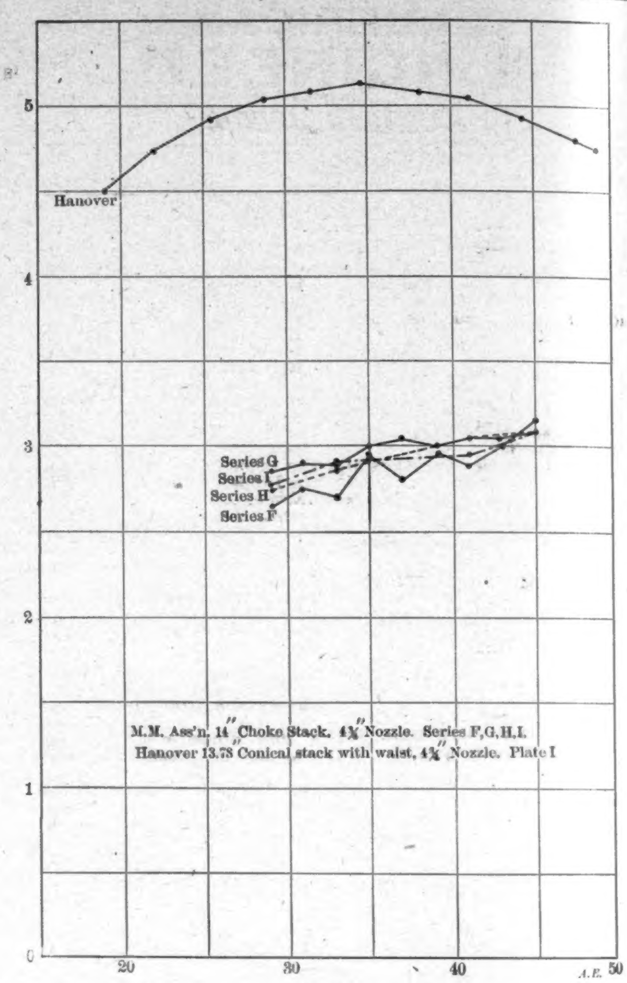

Fig. 2.

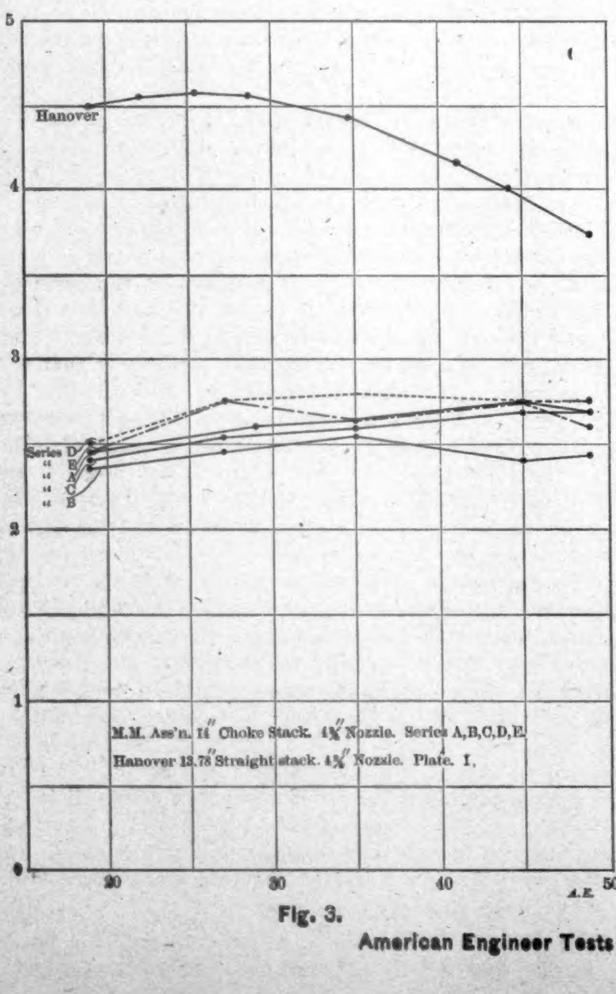

Fig. 3.

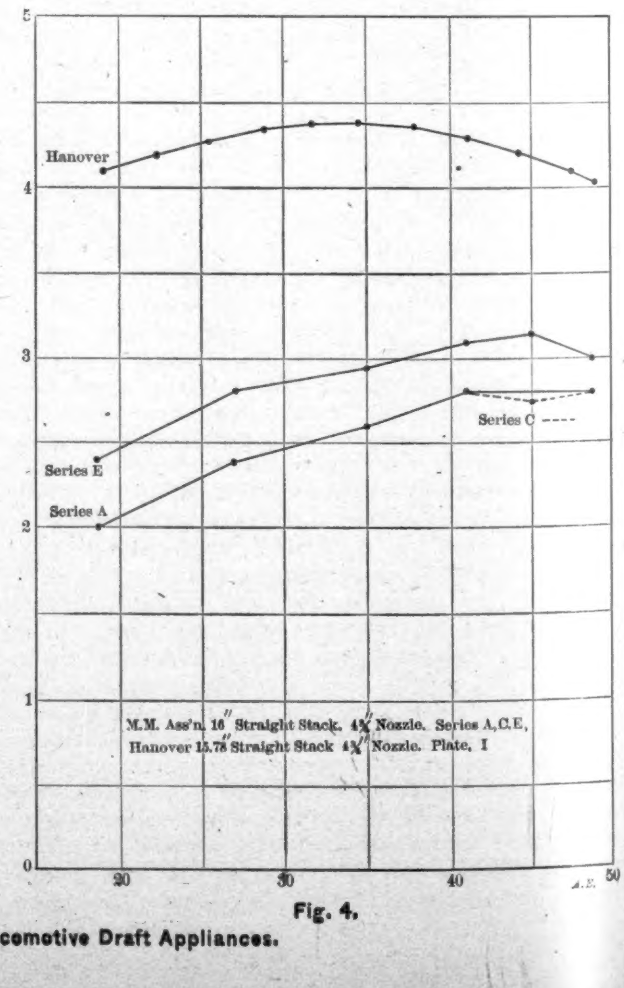

Fig. 4.

American Engineer Tests of Locomotive Draft Appliances.

ILLINOIS CENTRAL RAILR

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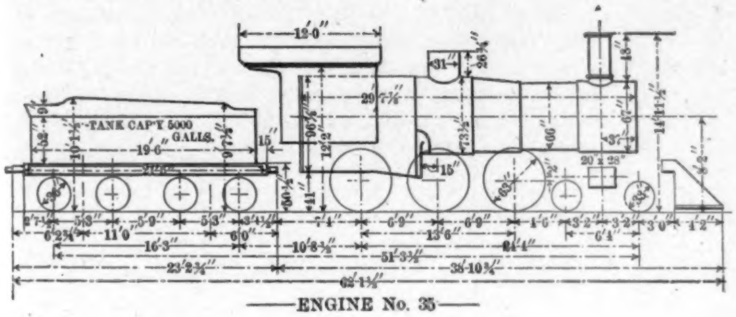
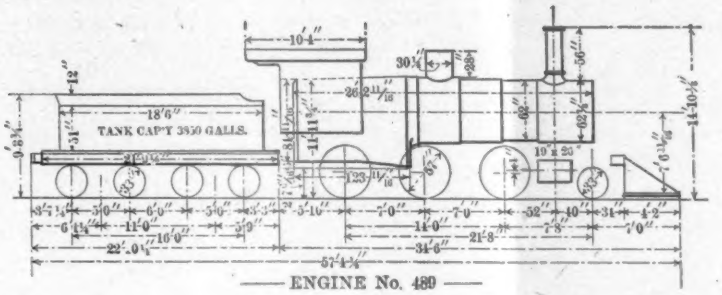
CENTRALIA DISTRICT.



—ENGINE No. 35—



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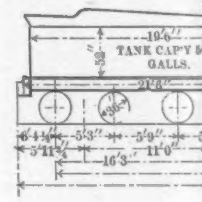
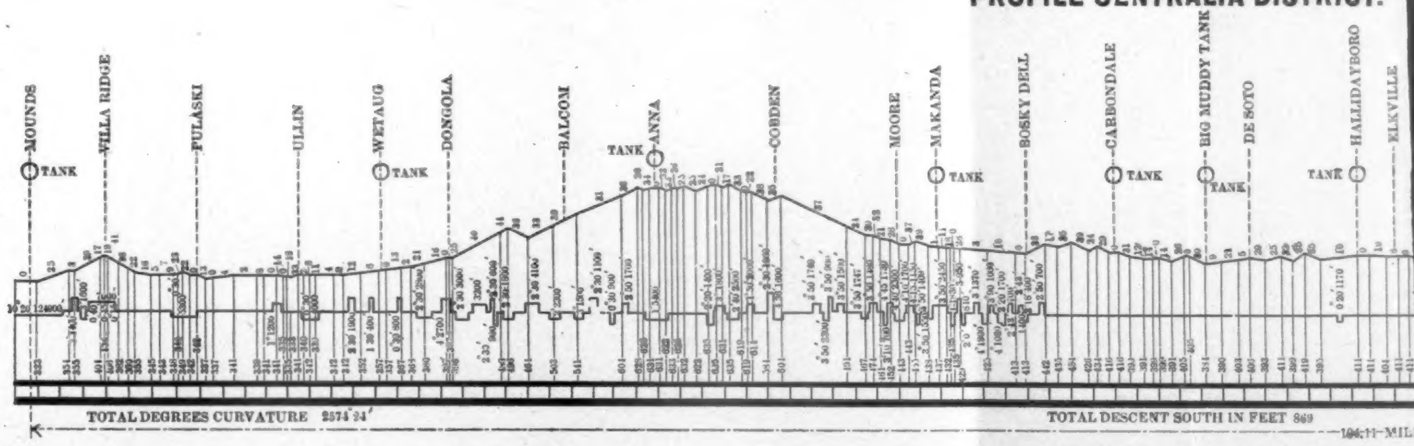


MECHANICAL MEMORANDA.

ENG. NUMBER	TYPE	BUILDER	CYLINDERS	DRIVERS No.	DRIVERS DIA.	WEIGHT ENGINE TRUCK	WEIGHT DRIVERS	WEIGHT TOTAL ENGINE	WEIGHT TOTAL TENDER	WEIGHT TOTAL ENG. & TEND.	TYPE	WORKING PRESSURE	DI
35	10 WHEEL	ROGERS	20″ x 28″	6	63″	34,900	122,300	157,200	102,000	259,200	WAGONTOP	180	6
489	MOGUL	BROOKS	19″ x 26″	6	57″	16,900	106,400	126,000	80,000	206,000	BELPAIRE	165	6
639	CONSOL	ROGERS	23″ x 30″	8	57″	18,200	134,800	203,000	105,400	308,400	BELPAIRE	210	8
640	12 WHEEL	BROOKS	23″ x 30″	8	57″	40,050	181,400	221,450	105,400	326,850	BELPAIRE	210	8

PROFILE CENTRALIA DISTRICT.



—NOTES—

TRAIN TONNAGE OBTAINED BY ACTUAL WEIGHT ON TRACK SCALES.
ONE GRADE OF COAL USED IN ALL THE ENGINES THROUGHOUT TEST.
ALL COAL USED WEIGHED ON PLATFORM SCALES WHEN LOADED ON TENDERS.
WATER MEASURED BY METERS & RECORD CHECKED BY TANK MEASUREMENTS.
OVERFLOW OF INJECTORS MEASURED & DEDUCTED.
ENGINES No. 35 & 489 EACH HAD ONE ENGINEMAN & ONE FIREMAN.
ENGINES No 639 & 640 EACH HAD ONE ENGINEMAN & ONE FIREMAN & ONE FIREMAN'S HELPER.
TRAIN CREW WITH EACH ENGINE CONSISTED OF ONE CONDUCTOR & TWO BRAKEMEN.

TRANSPORTATION MEMORANDA.

ENG. Nos.	No. OF TRIPS	MILES RUN	AVERAGE MILES PER HOUR RUNNING TIME	TRAIN: GROSS TONNAGE IN TONS OF 2000 LBS.	LOADED CARS NUMBER	LOADED CARS PER-CENT	EMPTY CARS NUMBER	EMPTY CARS PER-CENT	TOTAL CARS	AVERAGE CARS PER TRIP LOADED	AVERAGE CARS PER TRIP EMPTY	AVERAGE CARS PER TRIP TOTAL	TON MILES	TONS OF COAL USED	GALLONS OF WATER USED	AVERAGE TEMP. OF FEED WATER	AVERAGE STEAM PRESSURE	POUNDS OF WATER EVAPORATED PER POUND OF COAL	MIL RUN TON CO
35	96	10,000	20.24	103336	2480	71.22	1002	28.78	3482	26	10	36	10,763,613	565	817673	72°	177	6.028	17.6
489	96	10,000	19.05	101530	2183	63.84	1236	36.16	3419	23	12	35	10,573,494	608	876413	72°	163	6.003	16.
639	96	10,000	17.71	145738	3144	66.38	1592	33.62	4736	33	16	49	15,172,803	915	1,426403	72°	201	6.491	10.9
640	96	10,000	17.95	145161	3083	68.73	1754	36.27	4837	32	18	50	15,112,737	921	1,415429	72°	199	6.397	10.8

SUMMARY AND RESULTS OF TESTS.

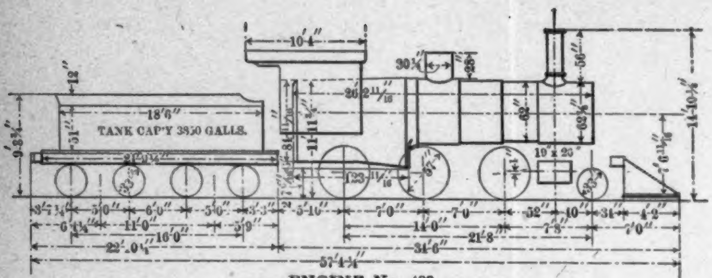
ENG. Nos.	DURATION OF TEST: FROM	TO	TOTAL TIME DAYS	TOTAL TIME H'RS	TIME IN SERVICE DAYS	TIME IN SERVICE H'RS	TIME IN SERVICE PER-CENT	TIME OUT OF SERVICE DAYS	TIME OUT OF SERVICE H'RS	TIME OUT OF SERVICE PER-CENT	SHORTEST LAYOVER AT TERMINALS	LONGEST LAYOVER AT TERMINALS NOT INCLUDING REPAIRS	AVERAGE LAYOVER AT TERMINALS NOT INCLUDING REPAIRS	TIME HELD FOR REPAIRS	TIME ON ROAD: RUNNING	STANDING	TOTAL	PERCENT RUNNING TO TOTAL TIME	PERCENT STANDING TO TOTAL TIME	TONNAGE RATING RULING GRADE	AVERAGE GROSS TRAIN TONNAGE OVER DISTRICT IN TEST TRAIN
35	MAY 3RD 1900	AUG. 6TH 1900	94	4	31	8	33.3	62	20	66.7	3HRS. 53MIN.	45HRS. 36MIN.	14HRS. 38MIN.	97HRS. 20MIN.	494HRS.	258 HRS.	752 HRS.	65.7	34.3	1050	1076
489	MAY 4TH 1900	AUG. 11TH 1900	101	3	36	4	35.8	64	23	64.2	3 " 15 "	33 " 32 "	14 " 14 "	142 " 10 "	525 "	343 "	868 "	60.5	39.5	900	1057
639	MAY 6TH 1900	AUG. 21TH 1900	110	23	38	11	34.7	72	12	65.3	3 " 10 "	47 " 05 "	16 " 21 "	275 " 29 "	565 "	358 "	923 "	61.2	38.8	1800	1517
640	MAY 4TH 1900	SEPT. 5TH 1900	124	3	40	20	32.9	83	7	67.1	4 " 55 "	36 " 48 "	15 " 32 "	485 " 10 "	557 "	423 "	980 "	56.8	43.2	1800	1511

NORWAY & CO., ENGRAVERS N.Y.

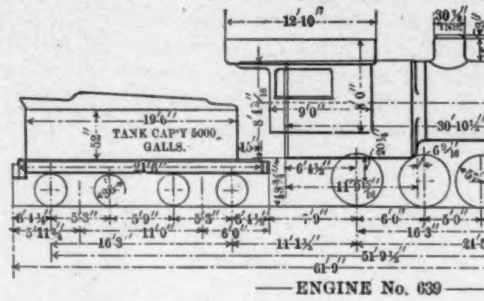
ILLINOIS CENTRAL RAILROAD CO

COMPARATIVE TEST OF LOCOMOTI

CENTRALIA DISTRICT.



—— ENGINE No. 489 ——

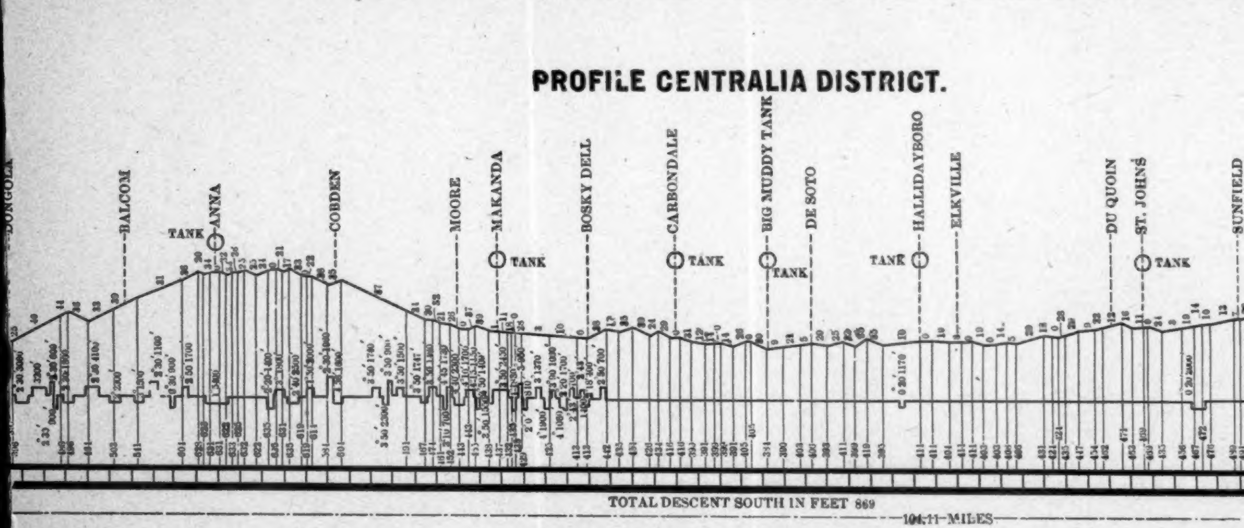


—— ENGINE No. 639 ——

MECHANICAL MEMORANDA.

ENG. NUMBER	TYPE	BUILDER	CYLINDERS	DRIVERS No.	DRIVERS DIA.	WEIGHT ENGINE TRUCK	WEIGHT DRIVERS	WEIGHT TOTAL ENGINE	WEIGHT TOTAL TENDER	WEIGHT TOTAL ENG. & TEND.	BOILER TYPE	BOILER WORKING PRESSURE	BOILER DIA.	FIREBOX LENGTH	FIREBOX WIDTH	FLUES NUMBER	FLUES DIA.	FLUES LENGT
35	10 WHEEL	ROGERS	20″ x 28″	6	63″	34,900	122,300	157,200	102,000	259,200	WAGONTOP	180	66″	120″	32″	304	2″ O.D.	13′-11
489	MOGUL	BROOKS	19″ x 26″	6	57″	16,900	106,400	126,000	80,000	206,000	BELPAIRE	165	62″	114″	33″	236	2″ O.D.	11′-1″
39	CONSOL	ROGERS	23″ x 30″	8	57″	18,200	134,800	203,000	105,400	308,400	BELPAIRE	210	80″	132″	42″	417	2″ O.D.	13′-8″
40	12 WHEEL	BROOKS	23″ x 30″	8	57″	40,050	181,400	221,450	105,400	326,850	BELPAIRE	210	82″	131″	41″	424	2″ O.D.	14′-8″

PROFILE CENTRALIA DISTRICT.



TRANSPORTATION MEMORANDA.

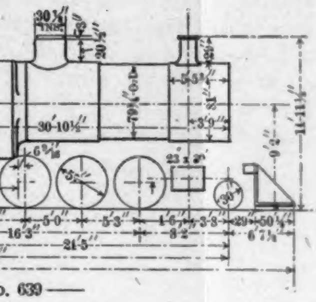
AVERAGE MILES PER HOUR RUNNING TIME	TRAIN GROSS TONNAGE IN TONS OF 2000 LBS.	LOADED CARS NUMBER	LOADED CARS PER-CENT	EMPTY CARS NUMBER	EMPTY CARS PER-CENT	TOTAL CARS	AVERAGE CARS PER TRIP LOADED	AVERAGE CARS PER TRIP EMPTY	AVERAGE CARS PER TRIP TOTAL	TON MILES	TONS OF COAL USED	GALLONS OF WATER USED	AVERAGE TEMP. OF FEED WATER	AVERAGE STEAM PRESSURE	POUNDS OF WATER EVAPORATED PER POUND OF COAL	MILES RUN PER TON OF COAL	TON-MILES PER TON OF COAL	OIL & WASTE	COA
20.24	103336	2480	71.22	1002	28.78	3482	26	10	36	10,763,613	565	817673	72°	177	6.028	17.60	19051	$37.39	$595.0
19.05	101530	2183	63.84	1236	36.16	3419	23	12	35	10,573,494	608	876413	72°	163	6.003	16.41	17391	23.55	618.0
17.71	145738	3144	66.38	1592	33.62	4736	33	16	49	15,172,803	915	1,426403	72°	201	6.491	10.92	16582	50.57	945.
17.95	145161	3083	68.73	1754	36.27	4837	32	18	50	15,112,737	921	1,415429	72°	199	6.397	10.86	16409	47 90	951.8

SUMMARY AND RESULTS OF TESTS.

LONGEST LAYOVER AT TERMINALS NOT INCLUDING REPAIRS	AVERAGE LAYOVER AT TERMINALS NOT INCLUDING REPAIRS	TIME HELD FOR REPAIRS	TIME ON ROAD RUNNING	TIME ON ROAD STANDING	TIME ON ROAD TOTAL	PERCENT RUNNING TO TOTAL TIME	PERCENT STANDING TO TOTAL TIME	TONNAGE RATING RULING GRADE	AVERAGE GROSS TRAIN TONNAGE OVER DISTRICT IN TEST TRAIN	PERCENTAGE AVERAGE GROSS TRAIN TONNAGE OVER DISTRICT TO RATING OVER RULING GRADE	COST TO HAUL 10,0 OIL & WASTE CENTS	COAL CENTS	REPAIRS CENTS	WAG OF ENG MEN A FIREM CENT
45 HRS. 36 MIN.	14 HRS. 33 MIN.	97 HRS. 20 MIN	494 HRS	258 HRS.	752 HRS.	65.7	34.3	1050	1076	102.5	3.47	55.3	8.14	60.5
33 " 32 "	14 " 14 "	142 " 10 "	525 "	343 "	868 "	60.5	39.5	900	1057	117.4	2.22	58.4	10.11	61.
47 " 05 "	16 " 21 "	275 " 29 "	565 "	358 "	923 "	61.2	38.8	1800	1517	84.3	3.33	62.29	10.33	61.
36 " 48 "	15 " 32 "	485 " 10 "	557 "	423 "	980 "	56.8	43.2	1800	1511	83.9	3.17	62.98	7.59	62.

COMPANY.

OTIVES.



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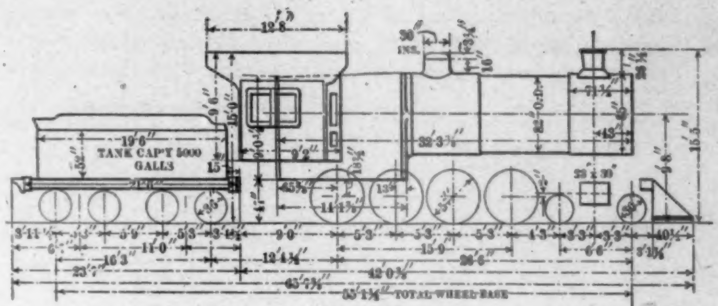
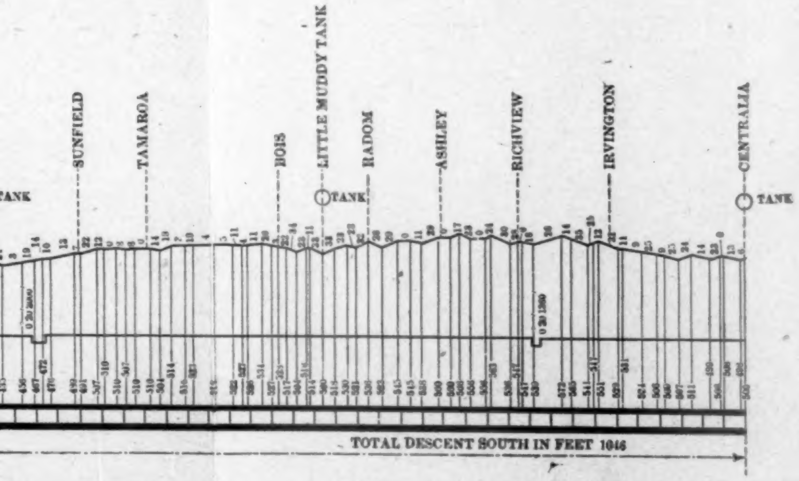


— ENGINE No. 640 —

FLUES		HEATING SURFACE			GRATE AREA
DIA.	LENGTH	TUBES	FIREBOX	TOTAL	
2" O.D.	13'-11"	2204□	192□	2396□	27.22□
2" O.D.	11'-1"	1358.57	173.08	1531.65	23.43□
2" O.D.	13'-8"	2982□	221□	3203	33.50□
2" O.D.	14'-8"	3237□	263□	3500□	37.50□



TOTAL DESCENT SOUTH IN FEET 1046

ITEMS OF COST					TOTAL COST
L & STE	COAL	REPAIRS	WAGES OF ENGINEMEN & FIREMEN	WAGES OF TRAINMEN	
.39	$595.09	$ 87.66	$ 651.47	$ 705.56	$ 2077.17
.55	618.09	106.92	650.27	733.56	2132.39
.57	945.23	156.76	910.53	754.56	2817.65
90	951.80	114.65	948.93	757.56	2820.84

—ANALYSIS OF COAL USED ON TEST ENGINES—

FIXED CARBON	47.86	PERCENT
VOLATILE COMBUSTIBLES	37.96	" "
WATER	6.24	" "
ASH	7.94	" "
SULPHUR	1.37	" "
B. T. U.	13622	

HAUL 10,000 TONS ONE MILE				POUNDS OF COAL USED TO HAUL 10,000 TONS ONE MILE	COMPARISON ON PERCENTAGE BASIS ENG. 35 BEING RATED 100%								
REPAIRS CENTS	WAGES OF ENGINEMEN AND FIREMEN CENTS	WAGES OF TRAINMEN CENTS	TOTAL COST		TONS OF COAL USED	TONS HAULED	TON MILES	WATER USED	POUNDS OF WATER PER POUND OF COAL	MILES RUN PER TON OF COAL	POUNDS COAL USED TO HAUL 10,000 TONS ONE MILE	COST TO HAUL 10,000 TONS ONE MILE	TOTAL COST
8.14	60.52	65.55	$ 1.93	1050	100	100	100	100	100	100	100	100	100
10.11	61.50	69.38	2.02	1150	107.54	98.23	98.23	107.18	99.59	92.76	109.52	104.66	102.65
10.33	61.01	49.73	1.86	1206	161.95	140.96	140.96	174.44	107.68	61.72	114.86	96.37	135.64
7.59	62.79	50.13	1.87	1219	163.01	140.40	140.40	173.10	106.12	61.39	116.09	96.88	135.80

A. E.

vacuum obtained; as the engine ran at a constant speed, with very nearly constant steam pressure, with the same cut-off these results are far more concordant than if the vacuum is increased in proportion to the drop in back pressure, since the back pressure given is simply the lowest point to which the exhaust line fell and does not represent the mean pressure in the exhaust pipe. If the vacuum obtained is divided by the back pressure the result is in all cases to show a still more rapid increase up to 45 ins., thus emphasizing the above statement. Fig. 3 shows the same curves for the 14-in., and Fig. 4 for the 16-in. straight stacks of the Master Mechanics' Association as compared with the 13.78-in. and 15.78-in. straight stacks on the Hanover tests. These stacks are all the same length from choke to top of stack, but with one decided difference, namely, that the Master Mechanics' Association stacks continued 14 and 16 ins. in diameter for 12 ins. from the choke until the smokebox was reached, whereas the Hanover stacks were conical, 17.59 ins. from the choke to a diameter of 17.72 ins. at the box.

After a careful study of the tests I am prepared to state that there would have been very little difference in the results had these stacks been similar to the Master Mechanics' Association form. Figs. 3 and 4 are plotted from series A, B, C, D, E in the Master Mechanics' Association experiments and show very clearly the same divergence from the Hanover results. Now while the divergence is not very serious in these particular instances, as it would simply lead to placing the nozzle rather higher than recommended in the report of the Master Mechanics' Association committee, it leads to a very much more serious question. Here is a considerable difference between results obtained on the Hanover tests apparatus and an actual locomotive, when the stack is fairly long and a small change in nozzle distance makes but little difference in the vacuum. Is this divergence going to increase and become more serious when the stack is short or of different size or when the proper nozzle distance becomes of considerable importance, as for instance in the condition shown in Plate III of the Hanover tests? And if so, how far can the results of the Hanover tests be depended on under such conditions,, which are certainly those which relate to the larger types of locomotives now becoming universal. I have little hesitation in saying that with our present knowledge of the subject this question cannot be answered, yet before discussing the best method of rendering available the vast amount of information on the Hanover tests I would call attention to two more series of tests on which comparisons are possible. Fig. 5 gives the results of Master Mechanics' Association series, M_1, O_1, Q_1, and deductions from similar tests from Hanover Plate II by assuming the vacuum to vary with the pressure. The 14-in. choke stack is used in both cases and the double line plotted from the Hanover tests shows the best vacuum obtainable and also the vacuum at a nozzle distance of 49 ins. with each size of nozzle. In this case there is a very fair agreement, although in the Hanover test the vacuum does not drop as rapidly when the nozzle diameter is increased.

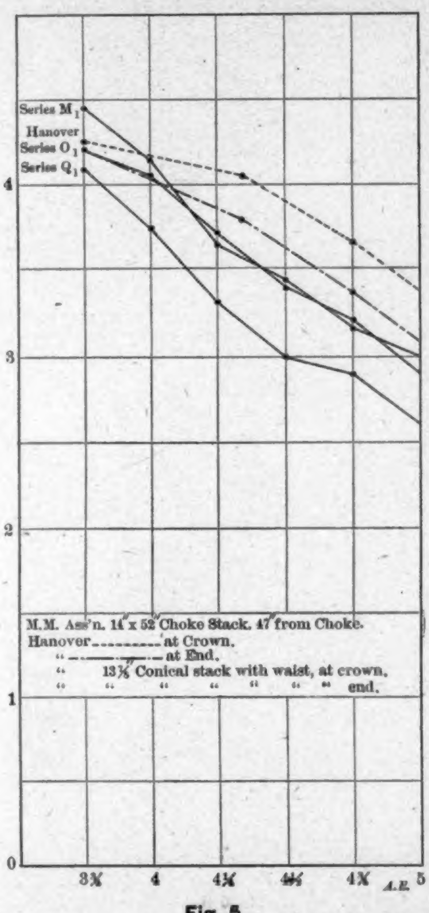


Fig. 5.

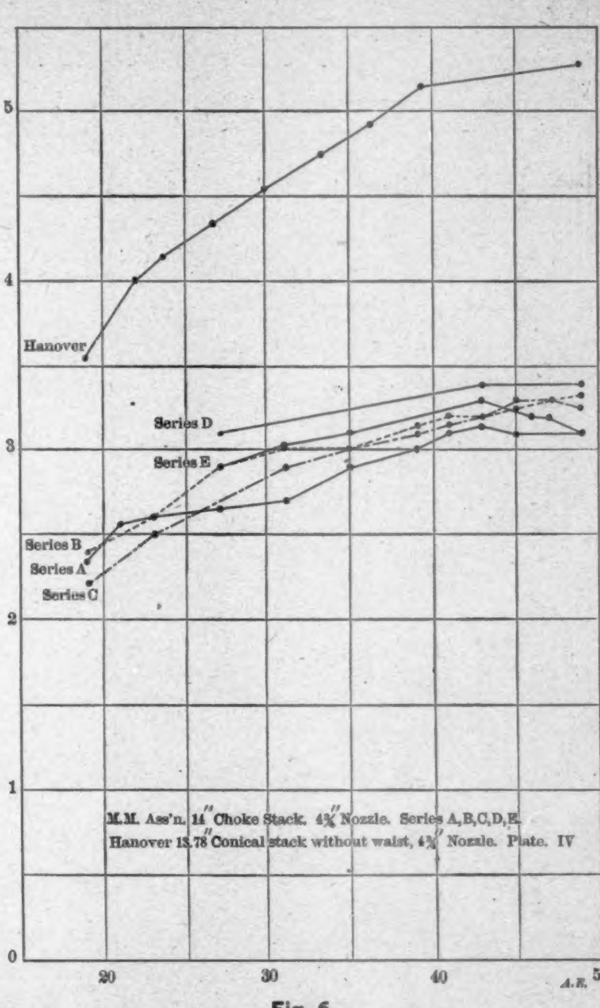


Fig. 6.

American Engineer Tests of Locomotive Draft Appliances.

Fig. 6 shows the Master Mechanics' Association series, A, B, C, D, E, with the 14-in. choke stack compared with the Hanover results from a stack 13.78 ins. at the bottom with 1 in 12 taper, but without waist, and 57.7 ins. long. The nozzle distances are, however, measured from a point 17 ins. above the bottom of the stack. The curve for this stack resembles very closely that for the 14-in. choke stack and would do so almost exactly if the scale were reduced in the proportion of 5.3 to 3.3, that of the vacuum recorded at the greatest nozzle distances. While this agreement is remarkable, it is not of much use in reconciling the differences, as this stack does not resemble the Master Mechanics' Association 14-in. choke stack as nearly as the one considered in Fig. 1.

(To be Continued.)

THE VANDERBILT STEEL HOPPER COAL CAR, 100,000 POUNDS CAPACITY.

Lackawanna Iron & Steel Company.

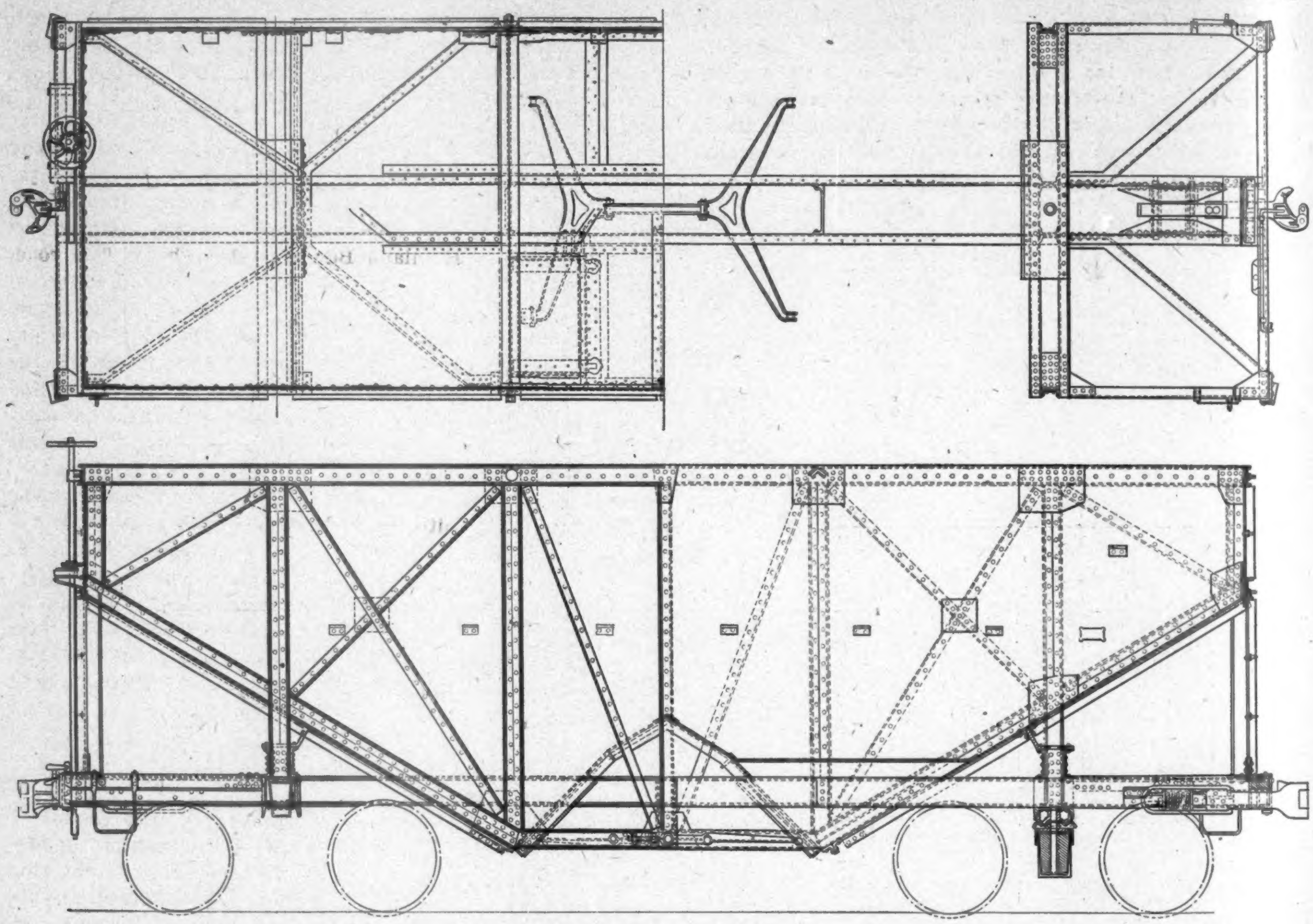
Designed by Cornelius Vanderbilt.

Through the courtesy of the designer, Mr. Cornelius Vanderbilt, we have received drawings of a new steel hopper coal car of 100,000 lbs. capacity, to be built for the Lackawanna Iron & Steel Company. Its construction presents new and interesting features which have been patented by Mr. Vanderbilt. The construction throughout employs structural steel shapes and plates. The leading dimensions of the car are as follows:

Vanderbilt Fifty-Ton Steel Hopper Car.

Light weight	36,500 lbs.
Weight of body	24,000 lbs.
Total capacity, coal	111,072 lbs.
Total capacity, ore	120,000 lbs.
Cubical capacity (30 degrees heap)	2,136 cu. ft.
Cubical capacity, level full	1,822 cu. ft.
Length, over end sills	31 ft. 10¼ ins.
Length, inside	30 ft. 0 ins.
Width, over all	9 ft. 11¼ ins.
Width, inside	9 ft. 0 ins.
Height, rail to top of brake staff	11 ft. 11 ins.
Height, rail to top of body	11 ft. 3 ins.
Height, rail to bottom of hopper	1 ft. 7 ins.
Height, rail to center of sills	3 ft. ⅜ in.

In order to secure the necessary strength with minimum dead weight the side framing is constructed in the form of trusses, to render their weight available in assisting in carrying the load. This idea has been employed before, but Mr. Vanderbilt's design is the first to take advantage of the entire depth of the side from the top rail to the bottom of the hoppers for this purpose. These trusses do not end at the floor line, but extend the full depth of the sides to the bottom of the hoppers. In fact, the side frames, used in this way, render it possible to reduce the center sills to 9-inch, 25 lbs. channels and side sills are omitted entirely. Steel plate ¼-in. in thickness forms the body of the car and is riveted to a trussed frame of channels stiffened and braced by angles, as indicated in the drawing. All of the chord, vertical and post members are of channel section, with a liberal number of angles and gussets. There are two hoppers with ridge plates over the center sills, and at the sides of the hoppers the bottom chord is a substantial channel connecting the sloping end channels and receiving, by means of gussets at its center, three of the bracing angles. The body bolsters are built up in the form of a box girder, with a lower or compression member in the form of a large channel receiving the center plate and bent up to meet the ends of the transverse channels. The center sills pass between these two portions of the bolster. The upper plate of this box girder is bent to form an at-



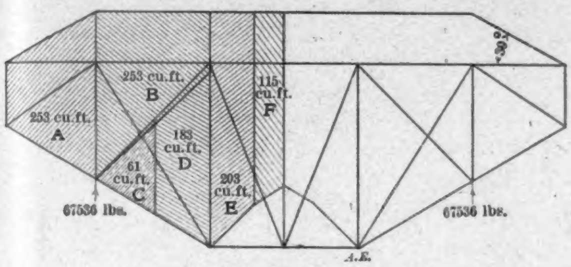
Vanderbilt Steel Hopper Coal Car—Lackawanna Iron & Steel Company.

Comparison of Fifty-Ton Steel Hopper Coal Cars.

Railroad.	Date.	Builders.	Construction.	Contents, 30° heap.	Coal capacity, 30° heap.	Light weight.	Ratio dead weight to paying load.
Lackawanna Iron & Steel Co.	1901	Not yet built	Vanderbilt, structural	2,136 cu. ft.	111,072 lbs.	36,500 lbs.	33.0 per cent.
Norfolk & Western	1900	N. & W. Ry	Composite	2,038 cu. ft.	112,000 lbs.*	38,000 lbs.	34.0 per cent.
Lake Shore	1899	Pressed Steel Car Co.	Pressed steel	2,072 cu. ft.	107,740 lbs.	36,600 lbs.	34.0 per cent.
Lake Shore	1900	Am. C. & F. Co.	Structural	2,140 cu. ft.	111,280 lbs.	38,300 lbs.	34.4 per cent.
Cleveland & Pittsburgh	1899	Pressed Steel Car Co.	Pressed steel	2,127 cu. ft.	110,600 lbs.	39,325 lbs.	35.6 per cent.
Baltimore & Ohio	1899	Pressed Steel Car Co.	Pressed steel	1,875 cu. ft.	97,500 lbs.	34,800 lbs.	35.7 per cent.
Northern Pacific	1898	Gillette-Herzog	Composite	1,842 cu. ft.	95,780 lbs.	37,400 lbs.	39.6 per cent.
Baltimore & Ohio	....	Pressed Steel Car Co.	Pressed steel	1,886 cu. ft.	98,072 lbs.	36,700 lbs.	37.4 per cent.
Erie	....	Pressed Steel Car Co.	Pressed steel	2,030 cu. ft.	105,560 lbs.	36,300 lbs.	34.4 per cent.
P. R. R.	....	Pressed Steel Car Co.	Pressed steel	2,056 cu. ft.	106,912 lbs.	39,600 lbs.	37.4 per cent.
L. V. R. R.	....	Pressed Steel Car Co.	Pressed steel	2,030 cu. ft.	105,560 lbs.	36,600 lbs.	34.5 per cent.

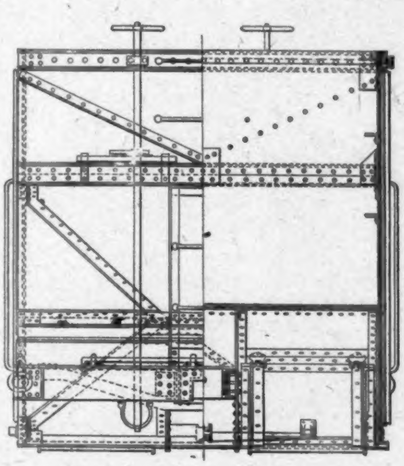
*Actual weight of test load.

tachment between two transverse angles riveted to the outer surface of the hopper plates, giving substantial support to the structure and constituting a rigid tie across the car at this point. At the ends of the body bolsters the load from the side frames is transmitted by vertical channels. The four points of support of the side frames are therefore at the ends of the bolsters and these vertical channels are riveted directly between the bolster channels. This arrangement of the bolsters, the end framing and side framing, with the various braces, may be easily understood from the drawings. At the



Stress Diagram.

termination of the sloping floor channels transverse channels pass across the ends of the car in such a way as to transmit end thrusts from the load to the side frame trusses. At the top of the sides and ends 6-in. channels give strength and



Half-Section and End Elevation of Vanderbilt Car.

stiffness. Cross ties of rods, protected by inverted angles, are provided at two points along the upper chords, while under the floor plating transverse tieing is provided for the lower portions of the sides. Channels are used for end sills, with castings to reinforce the center portions and compensate for the coupler shank openings. At the corners of the underframing bracing angles are riveted to the inner faces of the end sills, reaching diagonally to the center sills. The brake cylinders are mounted under the ends of the hoppers.

This construction will be better understood by considering the usual underframe of the car as dispensed with altogether and the weight carried on the body bolsters by means of the vertical struts of the side frames, which are attached to the ends of the bolsters. The office of the center sills is merely to connect the bolsters together and to deal with the pulling and buffing stresses.

In the weight diagram the various volumes are indicated by letters as follows:

A =	253 cu. ft. =	11.85% =	13,156 lbs.
B =	253 cu. ft. =	11.85% =	13,156 lbs.
C =	61 cu. ft. =	2.85% =	3,172 lbs.
D =	183 cu. ft. =	8.57% =	9,516 lbs.
E =	203 cu. ft. =	9.5 % =	10,550 lbs.
F =	115 cu. ft. =	5.38% =	5,980 lbs.
One-half of car,	1,068 cu. ft. =	50% =	55,536 lbs.
Total,	2,136 cu. ft. =	100% =	111,072 lbs.
Light weight of car body =			24,000 lbs.
Estimated weight of car,			36,500 lbs.

This car is very light. Its estimated weight with trucks is 36,500 lbs., and a new design of truck, which is not yet ready for publication, will probably reduce this weight slightly. In order to compare its weight and capacity with other cars of this type the accompanying table has been prepared. In a comparison of this kind, including the figures of different builders, it is assumed that the weights and capacities stated by them are correct. It will be noted that the Vanderbilt car heads the list with reference to the ratio of the light weight to the paying load. The capacity of this car for ore is 120,000 lbs.

A RAILROAD OWNED AND OPERATED BY "UNCLE SAM."

The United States is operating a railroad of its own, and does not make a cent out of it from one year's end to the other. Only a few miles from New York, on the Sandy Hook peninsula, is a six-mile steam railroad with Fort Hancock as one terminal and Highland Beach as the other. This road, while limited in its rolling stock to one locomotive, one combination baggage and passenger car, and several freight cars, is in touch with the whole country, as it connects at Highland Beach with the Central Railroad of New Jersey. Large operations in the line of ordnance tests are secretly conducted at the Sandy Hook proving grounds, by the Ordnance Department at Sandy Hook, and it is the transportation of this ordnance, together with ammunition and supplies, that furnishes the bulk of business of this railroad. The passenger traffic is small, as it is limited to those having passes issued by the military authorities of the United States. Aside from the inscription, "Sandy Hook Proving Grounds," which appears on the cars and locomotive, there is nothing about the train to suggest the ownership of the road. Nevertheless, it is Uncle Sam's own railroad, with an artillery sergeant as conductor and a competent traffic manager, Colonel J. B. Burbank, who is at present in command at Fort Hancock.

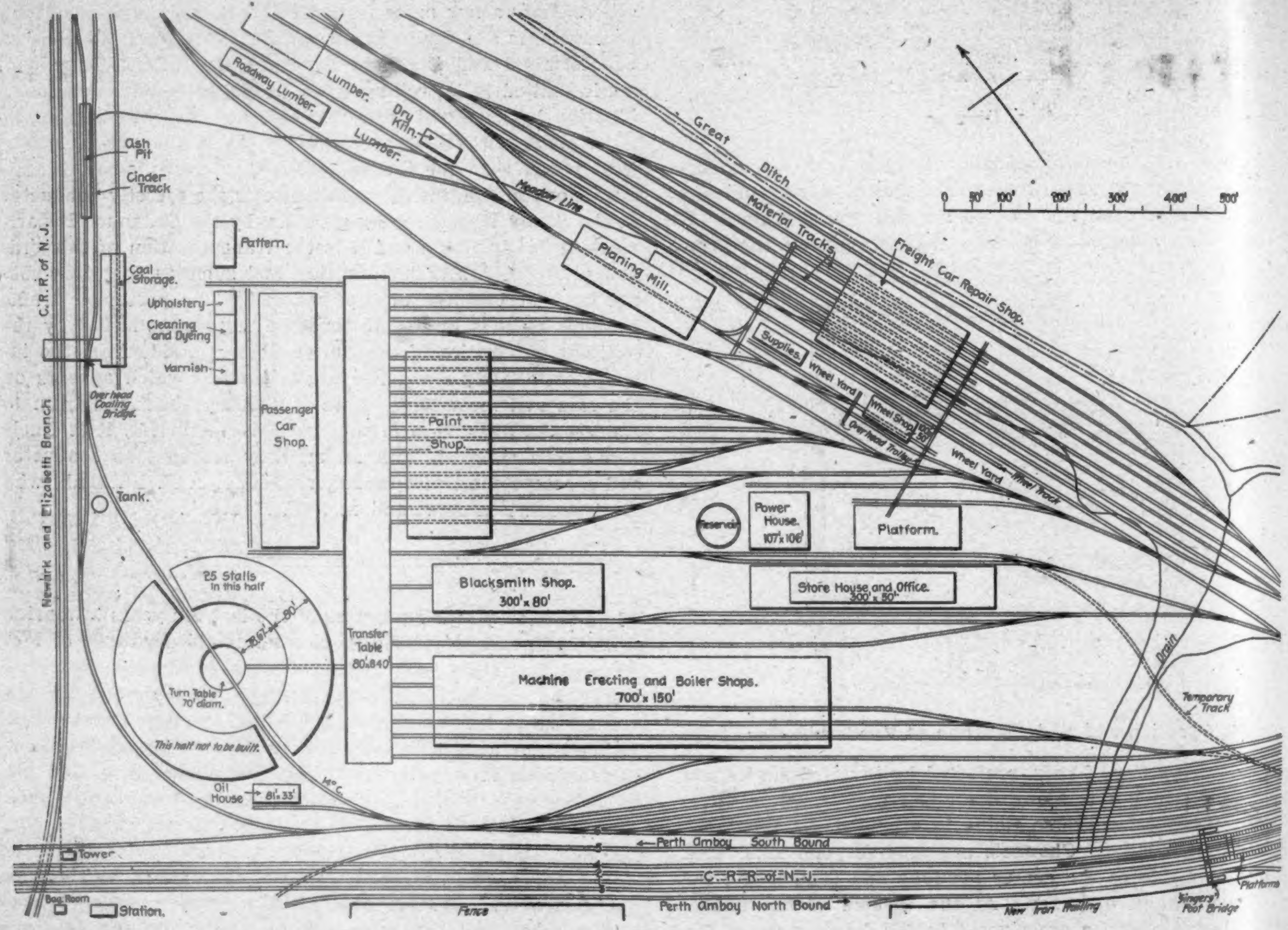
In a summary of the progress of the last ten years in marine practice, in a paper recently read before the Institute of Mechanical Engineers, Mr. James McKechnie showed that this branch has made remarkable strides. He summed up his conclusions as follows: Steam pressures have been increased in the merchant marine from 15 lbs. to 197 lbs. per square inch, the maximum attained being 267 lbs. per square inch, and 300 lbs. in the naval service. The piston speed of mercantile machinery has gone up from 529 ft. to 654 ft. per minute, the maximum in merchant practice being about 900 ft., and in naval practice 960 ft. for large engines, and 1,300 ft. in torpedo boat destroyers. Boilers also yield a greater power for a given service, and thus the average power per ton of machinery has gone up from an average of 6 to about 7 indicated horse-power per ton of machinery. The net result in respect of speed is that while ten years ago the highest sustained ocean speed was 20.7 knots, it is now 23.38 knots; the highest speed for large warships was 22 knots and is now 23 knots on a trial of double the duration of those of ten years ago; the maximum speed attained by any craft was 25 knots, as compared with 36.581 knots now; while the number of ships of over 20 knots was eight in 1891 and is fifty-eight now. But probably the result of most importance, because affecting every type of ship from the tramp to the greyhound, is the reduction in the coal consumption. Ten years ago the rate for ocean voyages was 1.75 lbs. per horse-power per hour; to-day, in the most modern ships, it is about 1.5 lbs. Ten years ago one ton of cargo was carried 100 miles for 10 lbs. of fuel, whereas now, with the great increase in the size of ships and other mechanical improvements, the same work is done for about 4 lbs. of coal—a result which means a very great saving when applied to the immense fleet of over-sea carriers throughout the world.

NEW LOCOMOTIVE AND CAR SHOPS OF CONCRETE CONSTRUCTION.

Central Railroad of New Jersey.

At Elizabethport, New Jersey.

The new shops of the Central Railroad of New Jersey at Elizabethport will take care of the heavy repairs on 430 locomotives, and maintain a car equipment of 20,000 freight and 500 passenger cars. The arrangement of building was made with a view of convenience in moving cars and material from one point to another, and after much thoughtful consideration in this direction and to the future extension of every building, the arrangement shown in the accompanying engraving of the general plan of the shops was decided upon. A 60-acre plot of ground bordering on Newark Bay and only 9 miles from the Jersey City terminal was selected as a site for tracks located between alternate repair tracks. Cars in this way will pass through the shop on certain tracks, according to the nature of their repairs, whether heavy, light or medium. An overhead trolley will carry all scrap parts from the rear end of the shop to the scrap platform, also the wheels to the wheel shop to be pressed off. Finished wheels and supplies, such as brasses and springs from the supply house, are taken in at the upper end of the repair shop, while those for the passenger car shop will be taken in car-load lots to that building. The lumber yard, dry kiln and planing mill are placed in line, so that the finished material will pass out at the rear end of the mill to the repair shop or to the passenger car shop. The latter building will be separated from the paint shop by an 80-ft. transfer table, so that cars will move in the one general direction through the paint shop out to meet the finished freight cars, and both find their way to the main line. This progressive movement has also been adhered to



General Plan of New Locomotive and Car Shops—Central Railroad of New Jersey.

WM. MCINTOSH, *Superintendent of Motive Power.* G. W. WILDIN, *Mechanical Engineer.*

the new shops, as this is the junction of the main line with the Newark and Perth Amboy divisions. The triangular shape of the grounds, with the tracks on the main line on one side, those of the Newark division on the second, and Newark Bay on the third side, added considerably to the problems of locating the tracks and buildings in such a way that every part of the shopyard would be in easy communication with every other part. By the use of a transfer table this plan has been successfully carried out.

As empty cars will naturally collect at this junction, those needing repairs will be switched into a yard for crippled cars, not shown, in the upper part of the grounds. The tracks for this storage yard are built on the gravity principle and finally converge into a single track, which again branches out into a series of tracks before reaching the freight repair shop. Seven of the tracks will run through the shop, with material as a principle in the locomotive shops. The buildings, including the machine, erecting and boiler shop, blacksmith shop, round house, power house, storehouse and office, oil house and transfer table, are already nearing completion. The car shops will not be built until later; at present attention is centered on the locomotive shops.

Running parallel with the main line of the road are the machine, erecting and boiler shops, which are in one building. This building is 700 by 150 ft., and is the only one of the entire group that is not of concrete construction. Its walls are brick, with a steel skeleton and concrete foundation 10 ft. wide at the base and rising to a height of 6 ft. above grade, where it tapers to a width of 2 feet at the top. A 12-in. brick wall rests on this foundation and is surmounted by a steel truss roof covered with 3-in. plank with a covering of tar and gravel. The building is formed of three bays, with longitudinal

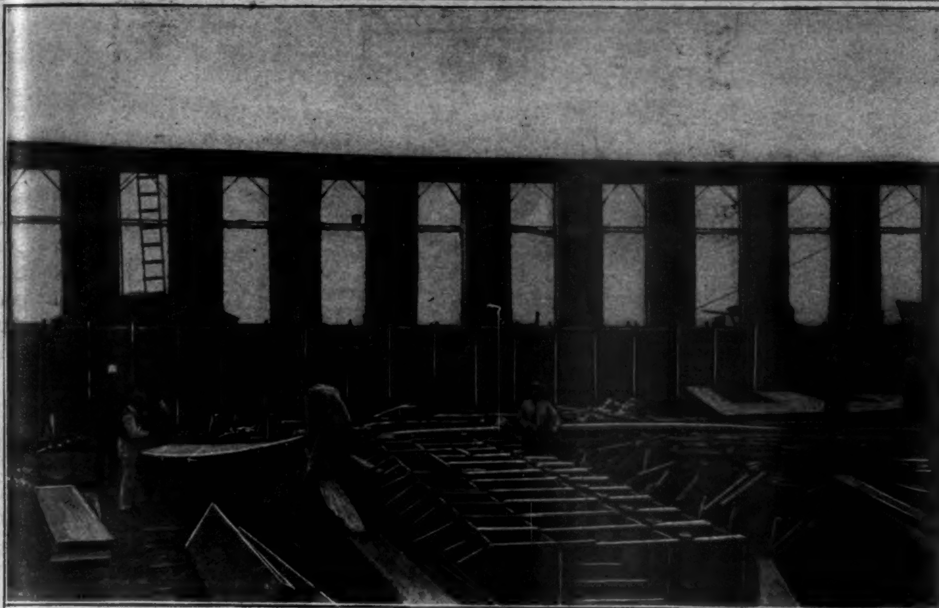


Fig. 1.

all of the tracks emerging from the rear of the paint shop will be built now, but are provided for when it becomes necessary to widen the building to accommodate more than three cars on each transverse track.

The transfer table, which is 400 x 80 ft., also serves the blacksmith shop and round house. The pit is entirely of concrete construction, in the form of parallel foundations prepared in the same manner as the pits of the round house shown in Fig. 1. The mould for the concrete pit, as will be noticed in the engraving, rests on a solid foundation of concrete. This foundation is 12 ins. in thickness, with a sheet of expanded metal at the bottom to aid in making a solid foot. Instead of employing piling this so-called "floating" foundation is used for all foundations throughout the entire plant, as the grade at this point is not much above the tide level, and water is encountered only a few feet below the grade.

tracks connecting with the transfer table. Upon these tracks the engines will be dismantled by the aid of an efficient crane service. The description of the arrangement of machines, the foundations, which are all of concrete and expanded metal, and the crane service will be reserved for a second article to appear in connection with the power house and power distribution, which is by electricity.

The tracks on either side of the machine erecting and boiler shop and next to the blacksmith shop all lead to the transfer table. Locomotives in this way can be brought from any part of the yard or direct through the round house to the machine shop. Not

Fig. 2.

Fig. 3.

Fig. 2 shows the exterior walls of the round house, which are 8 ins. in thickness, and Fig. 3 illustrates the bracing used in constructing the wall on the west side. The house is 400 ft. in diameter and equipped with a 70-ft. electric turn table. It is designed to house 50 engines, but at the present time only half of the house is being completed. Engines in coming into the round-house must first pass over the cinder pit before taking on coal and water. This arrangement is necessary, as considerable room is required in which to handle the tools in cleaning the grates of a hard coal burning engine. In front of the round-house is the oil house, 81 by 33 ft., which is constructed entirely of concrete, the roof as well as the walls and floors.

Back of the machine, erecting and boiler shops, are the store house and office building and the blacksmith shop. The latter building is 300 ft. long and 80 ft. wide, with concrete walls 8 ins. thick surrounding a framework of steel, as illustrated in Fig. 4. The store house is 300 ft. long and 50 ft. wide, constructed entirely of concrete, with walls 4 ins. thick. One end of the building is two stories high, the upper floor of which is to be used for offices. Surrounding the building is a platform built to the height of a car door, and it is accessible from

Fig. 4.

fact that it may be applied by cheap labor under the direction of a competent foreman who thoroughly understands mixing the concrete. This is quite important in avoiding labor difficulties. This material may be made in any form suitable to monolithic construction. It is durable, and when properly built upon expanded metal, there seems to be no anxiety as to its strength.

For the blue prints of the general plan of these shops from which the accompanying engraving was prepared, and also information regarding the arrangement of buildings, we are indebted to Mr. Wm. McIntosh, Superintendent of Motive Power, and Mr. G. W. Wildin, Mechanical Engineer, of the Central Railroad of New Jersey. The engineer and architect for the buildings is Mr. George Hill, of New York, who is making a specialty of concrete construction of this general character.

two tracks, one on either side, which lead to the transfer table.

The power house is another building, with floors, walls and roof of concrete. No attempt has been made at ornamenting any of the buildings, with the exception of the power house. This building is shown in Fig. 5 and is 107 ft. long, 106 ft. wide and 25 ft. high. A reservoir made of the same material is located at one side of the power house and will be used for storing rain water. All piping and wiring is to be placed in a concrete subway running the entire length of the machine, erecting and boiler shops. This tunnel extends through to the round house and has two branches, one to the blacksmith shop and the other to the power house.

In the present plant concrete construction has been used to the complete exclusion of masonry, except in the machine, erecting and boiler shops. Instead of using trap rock in the mixture, as is the ordinary practice in concrete construction, either cinders, furnace slag, sand and cement or gravel, sand and cement, are used. In every instance the mixture was about 4 to 1.

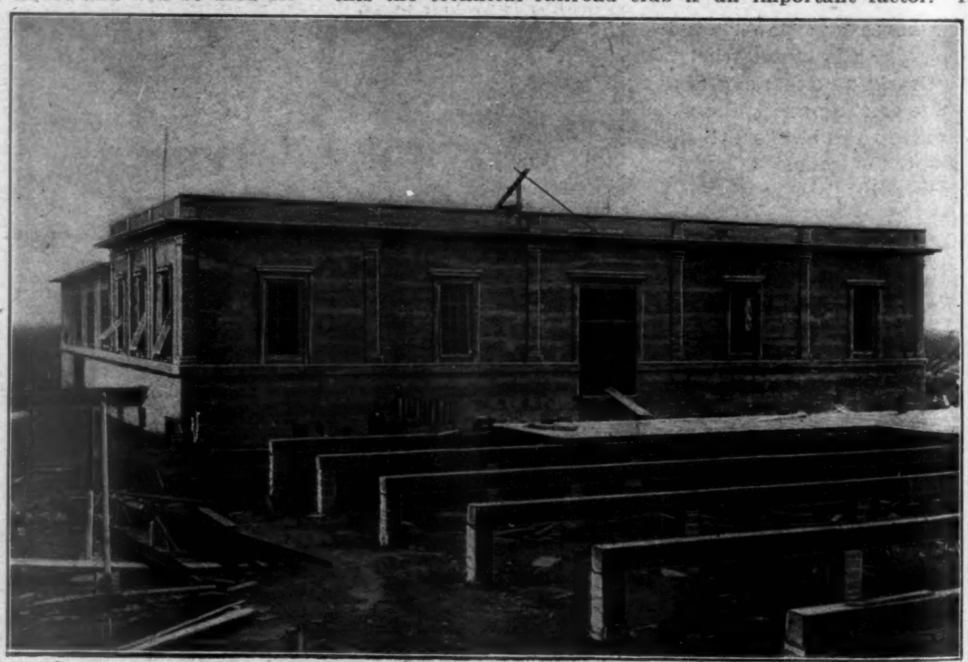


Fig. 5.

There appear to be good reasons for believing that concrete construction of foundations and buildings will become quite general. Cement is improving in quality and its cost is decreasing. For this construction the concrete is poured into molds made of pine boards, tongued and grooved, and, by exercising a little thought, an entire building may be constructed with a few molds and repeating small sections. In these buildings it will be noted that the walls are thin. This is an advantage offered by concrete. In the case of the west wall of the roundhouse temporary bracing is required, but this will be taken out when the round-house is completed to its full capacity of 50 stalls. Another advantage of concrete is the

A new railroad club was organized in Pittsburgh October 18, known as the Railway Club of Pittsburgh, this being a large and important railroad center. The era of railroad building on a huge scale is passed and one of improvement has begun. In this the technical railroad club is an important factor. The discussion of technical subjects by the men who are dealing with them individually is one of the methods of the present which means much for the future. This club begins with a membership of 50 and with the following officers: President, Mr. J. H. McConnell, General Manager of Pittsburgh Works of the American Locomotive Company; Vice-President, Mr. L. H. Turner, Superintendent of Motive Power of the Pittsburgh & Lake Erie; Secretary, Mr. J. D. Conway, of the Motive Power department of the Pittsburgh & Lake Erie; Treasurer, Mr. J. D. McIlwain; Executive Committee, Messrs. D. F. Crawford, of the Pennsylvania Lines; J. E. Simons, of the Pittsburgh Coal Company, and Mr. F. T. Hyndman, of the Pittsburgh & Western Railway.

TESTS OF LIGHT AND HEAVY LOCOMOTIVES.

Illinois Central Railroad.

Showing Heavy Locomotives to Be Advantageous When They May Be Loaded to Capacity.

With an Inset.

By the courtesy of Mr. A. W. Sullivan, Assistant Second Vice-President, and Mr. William Renshaw, Superintendent of Machinery of this road, we are permitted to describe an important test comparing heavy and light locomotives.

On the Centralia District the limiting grade is on the Makanda hill. The freight locomotives in service about three years ago had normal ratings of about 1,000 tons or less over this grade, but over the rest of the district, 104 miles long, there was no difficulty in hauling much heavier trains. To ascertain the operating advantage of heavier locomotives the Brooks and the Rogers Locomotive Works were each asked to build an engine which would pull trains of 2,000 tons over the summit. The builders were not restricted or hampered as to details. The engines were built and placed in service. The Brooks design, of the 12-wheel type, was illustrated in our issue of October, 1899, page 315, and that of the Rogers Works, of the consolidation type, in that of January, 1900, page 12. The former is the heaviest locomotive ever built, and the latter somewhat lighter. These large engines have 23 by 30-in. cylinders and carry 210 lbs. boiler pressure. Their dimensions are given in the accompanying inset.

An opportunity was offered to ascertain definitely the relative costs of operation of the new, very heavy engines and those of lighter weight which were formerly standard engines on this road. It became necessary to know positively whether or not more large engines should be built, or whether the lighter engines were to be continued as standard. This led to a road test, comparing the large engines with a 10-wheel and a mogul. The cylinders of the 10-wheel engine are 20 by 28 ins., and of the mogul 19 by 28 ins. The steam pressures of these engines are 180 and 165 lbs., respectively. As the management was in earnest to know what practice to follow, the tests were made without reference to cost or inconvenience, and the records were prepared and studied with great care.

The entire report appears in a single blue print giving diagrams of the four locomotives, a profile of the district, a table of mechanical data, transportation memoranda and the summary of results. These are reproduced entire. The profile diagram gives the stations, grades in feet per mile, elevations, curves, the mile posts, and from the diagram there appears to be but 177 ft. difference in elevation at the terminals of this district. The record also gives the analysis of the coal used.

Each of the locomotives ran 10,000 miles, requiring from 94 to 124 days for the tests. Each engine was accompanied on its 96 trips by a special apprentice, who was a technical school graduate, and these young men were under the direct supervision of Mr. W. H. V. Rosing, Assistant Superintendent of Machinery, who gave his personal attention to the work. All the trains were weighed on track scales, and one grade of coal, all from the same mine, was used throughout. It was weighed on platform scales before being delivered to the tenders. Water meters were used to measure the water, and these were checked by tank gauge measurements. The injector overflow was measured and deducted. These data were taken in order to ascertain all the conditions of operation, the final comparison being expressed in the cost in dollars and cents to haul 10,000 tons one mile.

The record speaks for itself, and is worthy of most careful study by every mechanical and operating officer, for it contains information which very few have undertaken to secure at all, and for completeness this case stands alone. We have never seen a more comprehensive record, including cost of repairs and wages.

These results need careful consideration or they will be misunderstood, and in view of the tendency toward increasing the power of locomotives the figures are exceedingly significant and valuable.

The Illinois Central probably will not build more of these heavy engines, but this decision needs explanation. In this case, because of peculiar conditions of the traffic, it was found impossible to gain the full advantage which the large engines would give if completely loaded. It was impossible to load the heavy engines up to their economical capacity without holding them for full trains, which could not be done. Whereas these engines ought to haul 1,800 tons, but 1,500 tons could be given them. Furthermore, the big engines required an extra man to assist the fireman. At this point attention should be called to the fact that these two heavy locomotives have narrow fireboxes. If they were to be built now they would doubtless have at least 30 per cent. more grate area. Because of the significance of these figures the relative cost of hauling 10,000 tons one mile is repeated here. These figures are from the 10-wheel mogul, consolidation and 12-wheel engines in the order named.

Cost to Haul 10,000 Tons One Mile.

				—Wages.—		
Engine No.	Oil and waste. Cents.	Coal. Cents.	Repairs. Cents.	Engineers and firemen. Cents.	Of trainmen. Cents.	Total cost.
35	3.47	55.8	8.14	60.52	65.56	$1.93
489	2.22	58.4	10.11	61.50	69.38	2.02
639	3.33	62.29	10.33	60.01	49.73	1.86
640	3.17	62.98	7.59	62.79	50.13	1.87

In oil and waste there is no important difference; the 10-wheel engine, however, was the most expensive in this item. The big engines cost more in fuel. In repairs the heaviest engine was the lowest, and we are informed that the relatively high repairs of engine No. 639 were not due to its being a large engine. In spite of the extra man required for each of the large engines, No. 639 had the lowest item of wages of the engine crew. It is in the saving in train-crew wages that the greatest difference appears. The train crews consisted of one conductor and two brakemen.

The heavy engines, though handicapped, operated more economically than the others, and to us the tests seem to be an unqualified proof of the correctness of the policy of building heavy locomotives—if they can be properly loaded. This is understood to be the view taken by the Illinois Central officers. No business originates between the terminals of this district, and nearly all of the traffic is time freight. Even the coal business must be hurried, because of peculiar storage conditions in Chicago. The difficulty is purely one of traffic conditions. In ore, timber or ordinary coal traffic these big engines would have stood out head and shoulders above the others instead of showing a small margin.

Incidentally, it may be worth mentioning that comparisons of this kind are impossible without the ton-mile basis for locomotive statistics.

There are many interesting facts brought out in these tables which we must leave to the reader to discover.

General interest in the American Engineer Tests on Locomotive Draft Appliances is shown by the large number of communications received from railroad officers and others interested in this subject. Because of its suggestiveness, one of these, from Mr. C. M. Muchnic, is printed in this issue. Suggestions and criticisms are acceptable, and they will receive careful consideration. It is difficult to realize the breadth of this subject, and after our thorough preliminary study of it, new phases of the problem continually appear. The extent of the work will perhaps be better understood from a statement that in studying the effect of 7 different heights of nozzles, 4 heights of stacks, 4 diameters of stacks, 2 shapes of stacks and 3 different rates of driving, as many as 672 conditions will be investigated. This is for the study of the subject of nozzles and stacks alone. Consideration of the other factors develops an increasing number of interesting conditions requiring investigation, and these will be treated in turn. In order to get at all of the factors and their relationships, a well-equipped testing plant could be kept busy for several years. There is evidence in abundance to indicate that the subject selected is one of most vital interest.

WATER PURIFICATION.

Chicago, Burlington & Quincy.

An Automatic Process.

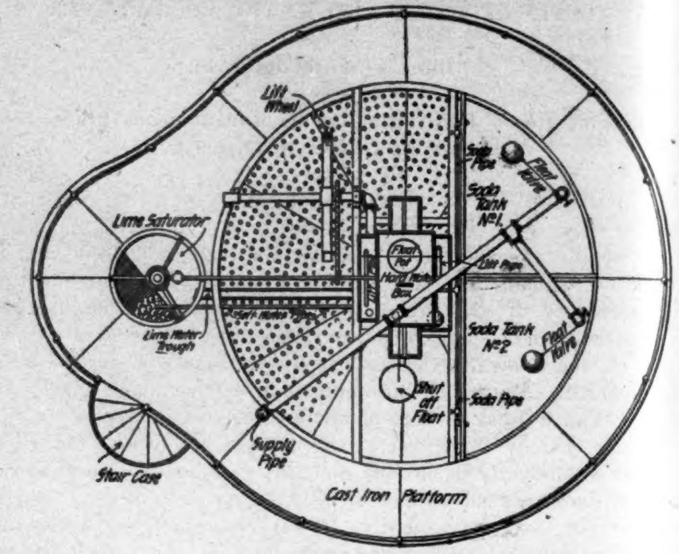
For many years the Chicago, Burlington & Quincy has given a great deal of attention to the water supply for its locomotives. Until recently, however, efforts have been confined to a thorough study of the water and toward the selection of improved supplies when possible. At Quincy and Galesburg filter installations have been completed, the former being now in use, but the latter has not yet been put into service. At Buda, Illinois, 117 miles from Chicago, where the water contains nearly 21 grains of scale-forming solids per gallon, a new water softener has been put into service. This water is the worst used on this road in Illinois, and it is an important supply, furnishing at present about 75 locomotives per day. The normal capacity of the machine is 9,500 gallons per hour, but

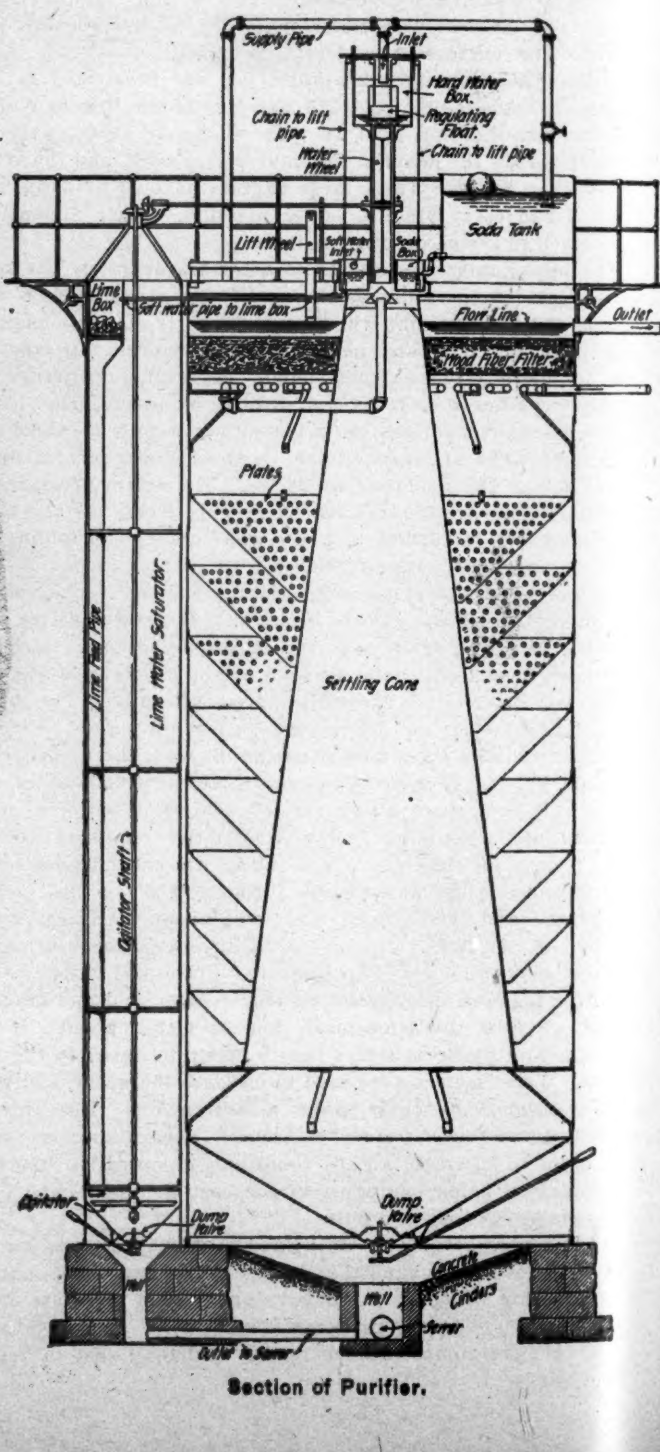
Water Service on the Chicago, Burlington & Quincy.

as the rating is very conservative, the real capacity is much greater.

The most interesting and striking feature of the plant is that it is automatic and that as long as the character of the raw water does not change the machine requires attention only for the supply of chemicals and for cleaning out. A representative of this journal recently made a thorough examination of this plant and a description will undoubtedly interest our readers, because of the necessity for securing good boiler water under present conditions of locomotive service. It is unnecessary to present the reasons for this, because our readers undoubtedly appreciate the effect of bad water upon the fuel account, the cost of repairs and the continuity of service of locomotives, which is such an important item when business is so heavy.

The accompanying engraving illustrates the construction and operation of the machine at Buda. The apparatus is contained in and mounted on a cylindrical shell about 12 ft. in diameter and about 40 ft. high. This is mounted on a concrete foundation and is located near three elevated storage tanks having combined capacity of about 170,000 gals. An 8-in. pipe, reaching over the top of the cylinder, brings the raw water from





Section of Purifier.

"Coal Creek," a distance of 1⅛ miles, the pump being located at the creek. Some of the water is from the surface, but most of it is from springs, the supply being permanent. Over this section of the road soda ash has been used in the tenders for some time, but engines taking water at this point have discontinued its use.

The water to be treated is brought to the center of the vertical cylinder, where it discharges into a hard-water box, shown in the engraving. From this box the water, on its way to the purifier, turns a water wheel from which the power required for the machine is derived. After leaving the wheel it passes to the top of the settling cone. At this point it is mixed with the treating solutions, which, in this case, are limewater and soda. Upon mixing with the chemicals lime, magnesia, iron, alumina and a portion of the silica (if the water contains it) begin to settle out, and the process continues.

Because of its shape the cone permits the water to gradually reduce its velocity, which assists in the settling. From the bottom of the settling cone the water passes up through the outer space, where the settling is continued and aided by a large number of baffle plates. Before passing to the outlets the treated water finally passes through a filter of wood fiber. The water passes through the machine without loss of head, and on its way automatically regulates the supply of the chemicals.

The lime and soda solutions are prepared separately. At one side of the main cylinder a smaller, and sometimes shorter cylinder, 25 ft. high, is secured. This is open at the top and an agitator at the bottom of a vertical shaft stirs up the contents. From the top of the lime saturator a trough takes the limewater to the top of the settling cone. A lift wheel, driven by the water wheel, raises some of the treated water into a box. From here it passes by gravity to the lime saturator through the orifice marked "soft water inlet."

On the other side of the water wheel is the soda box, which is kept full from the soda tanks by a ball valve. There are two soda tanks for use alternately. The relative amounts of soda and lime solutions are determined by the sizes of the orifices through which the solutions pass out of the small tanks at each side of the water wheel. These openings are slits in the ends of pipes. The pipes have swing joints at their fixed ends, and by raising the free ends the flow is reduced by reducing the "head." These lift pipes are controlled by a float in the hard-water box, so that the chemicals will be governed by the amount of raw water entering the machine. A valve in the main supply pipe is controlled by a float in the top of the cylinder, resting upon the treated water. This float will stop the whole machine if the water level for any reason becomes higher than the normal. At Buda the outlets open directly into the three elevated tanks, and the water flows by gravity. At the bottom of the settling cone and lime saturator the sludge is removed by valves opening into a drain. A neat cast-iron platform with a railing surrounds the top of the machine.

The effect of the process on the water is given in the following table, in which the quantities are expressed in grains per gallon:

ANALYSIS BEFORE AND AFTER TREATMENT.

	Before.	After
Sodium chloride	0.36	0.40
Magnesium chloride	0.23	none
Sodium sulphate	none	1.80
Alkalies (non-incrusting)	0.59	2.20
Calcium carbonate	9.64	2.43
Calcium sulphate	3.03	0.24
Magnesium carbonate	7.80	0.74
Silica and iron oxide	0.29	0.20
Incrusting solids	20.76	3.61

The apparatus is the Kennicott Water Softener. It was installed under contract with the J. S. Toppan Company, Agents, 77 Jackson Boulevard, Chicago. This company is now employed upon extensive investigations of the water supply of several well-known railroads, with a view of improving the supply by treatment with their apparatus. They have installed a number of plants which are now in use.

THE BOLSTER VS. THE SIDE BEARING.

The effect of recent improvements in operation of railroads is seen in many efforts to cut down and eliminate losses which were formerly not thought of at all and were considered unavoidable. One of these is involved in the very unsatisfactory practice in connection with center plates and side bearings. These details not only influence the resistance of trains, but also the wear of wheels and rails and the safety of the flanges. Altogether the subject is perhaps second only to that of draft gear in importance in connection with car construction.

While the M. C. B. Association has twice appointed committees to report on this subject nothing definite has been accomplished except to emphasize its importance. There was no report by the committee at the recent convention, but the opinions secured in conversation with several prominent members indicate that there is a marked tendency toward a change of opinion with reference to the functions of side bearings.

With the ordinary side bearings it is necessary to provide sufficient rigidity in the bolsters to prevent bringing these bearings into contact by deflection and the question then becomes: Shall bolsters be made stiff enough to keep the side bearings apart, except as a result of rocking of the car, or shall the side bearings be utilized at all times to carry the load? If side bearings are to be depended upon for the load, relief in the matter of weight of bolsters will be had and it is becoming apparent that weight in bolsters is now a factor in car design. Some of the modern metal bolsters are holding the cars up and some are not. It will not be questioned that bolsters must not be lighter, but in many cases much heavier than they are now in order to hold the side bearings apart. Is it worth while to make them heavier if a satisfactory side bearing is available for permanent and continuous loading? The answer to this depends upon the qualities of the so-called "frictionless" side bearings. Several authorities have expressed themselves as ready to support their cars on three points at each end when they are satisfied that the proper side bearing is available. It may be inferred that these men have the various "frictionless" side bearings in trial service. If not they should begin such an investigation.

Center plate design cannot be considered independently of the side bearings. If the side bearings are kept apart through the stiffness of the bolsters the resistance of the truck to curving comes upon the center plate. It should therefore be so made as to offer the least possible resistance. On the other hand, if side bearings are improved in extent permitting of their use as permanent supports, it is inconsistent to neglect the improvement of the center plate and this view leads to the conclusion that, whatever is done as to side bearings the center plate should be made as nearly frictionless as possible. It is too late a day to require reviewing the advantages to be derived from a reduction in the resistance of trucks to turning. These are thoroughly understood.

Like draft gear, the improvement of center plates and side bearings is necessary for old as well as new cars and it is specially necessary in modern steel coal cars of the hopper type with extremely high centers of gravity. In fact, it was in conection with these high cars that the expressions of opinions referred to arose. It is immediately apparent that a high center of gravity and a 50-ton load is likely to cause large stresses on the bolsters if even a slight opening between the side bearings is permitted. In swinging at the entrance of a curve the momentum of such a load must cause excessive blows upon the bolsters as the motion is arrested by the side bearings and the shocks are agravated by the motion at these bearings. Authenticated records of damaged bolsters support the opinion that this is likely to become a serious matter. While it is possible to provide for the ordinary deflections due to load and to use metal enough in the bolsters to carry the loads on the center plates this destructive rocking action is not to be laid, as a fault, to the bolsters, but to a defect in

side bearings whereby the motion is permitted to become destructive. A close-fitting ball or roller side bearing seems to offer a solution of this difficulty. The side bearings of such cars should be in contact and this at once necessitates the use of improved side bearings.

It should not be thought that the failure of the M. C. B. Association to discuss the subject at the recent convention indicates that it is unimportant or that the problem has been accepted as solved.

THE SECRET OF SUCCESS.

The following paragraph was received from a correspondent. It is commended to everyone who is in a responsible position in charge of the direction of the efforts of others:

"The secret of the success of the great business enterprises of the world lies in the talent of some man at the head to get folks who can do things and then let them alone to do them. It requires much less talent and genius to find the man to 'deliver the message' than to keep your hands off and let him do it. One business that the writer knows of has practically reached the limit of its expansion because the man at the head of it isn't big enough to let folks do things; he is always interfering with the method; his employees have no individuality in their work; they try to do it 'to please the old man' rather than to promote the business, but he doesn't encourage the expression of them; he overrides new suggestions because they 'cost too much,' or because he doesn't 'consider them practical' or because the man who makes the suggestion 'doesn't know anything about it.' This is a discouraging case for an employee who really wants to improve his own condition by improving the business he is in."

The Pressed Steel Car Company's output of cars up to October 24 aggregates 50,091, enough to make a train of steel equipment over three hundred miles long.

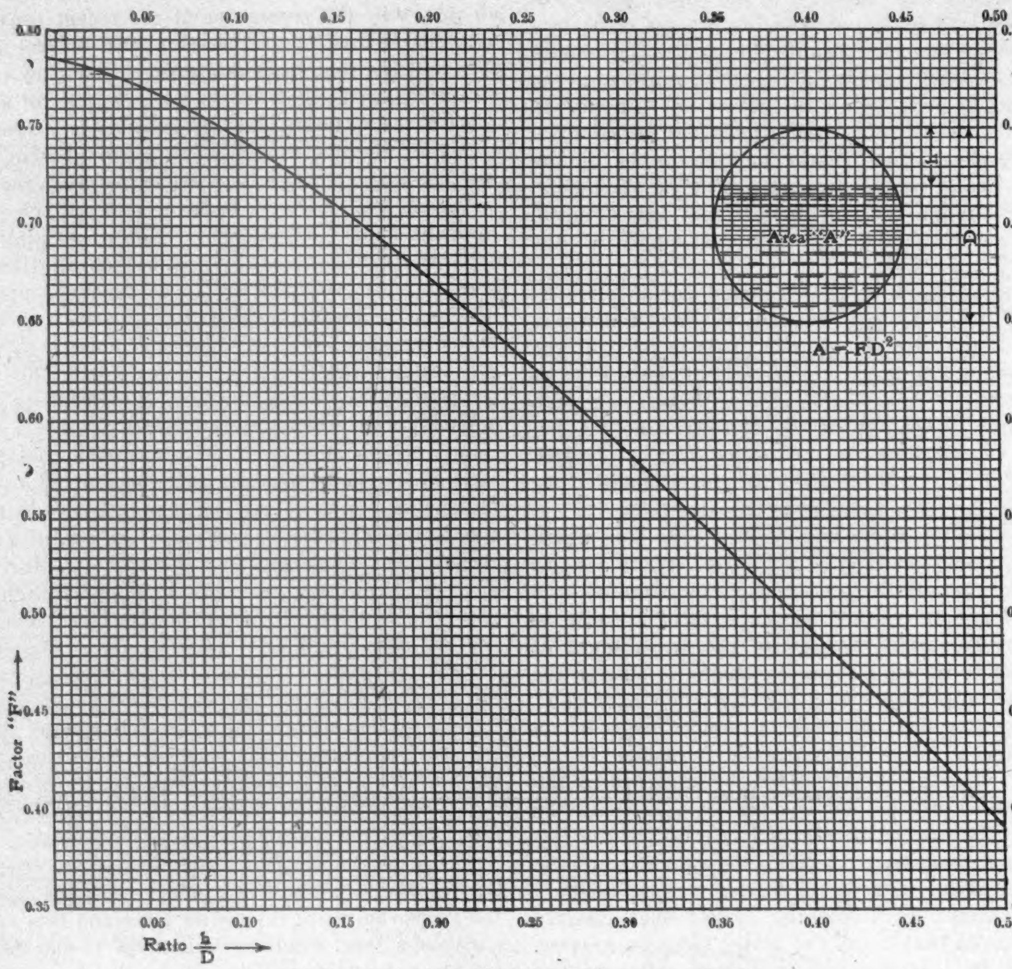
TO DETERMINE THE WEIGHT OF WATER IN A BOILER.

By Lawford H. Fry.

The following method was developed as a means of determining easily and with reasonable accuracy the weight of water contained in a locomotive boiler of given dimensions. Comparisons of results calculated by this method, with actual weighings, show that the calculated results come well within the limits of accuracy required in practical work.

The process consists of two operations; first, the determination of the weight of water in the waist, and second, the determination of the weight of water surrounding the firebox.

Considering a cross-section of the waist, the area of



To Determine the Weight of Water in a Boiler.

the water is the area of the segment below the water level, less the area of the flues. The area of the segment of a circle is obtained from the formidable formula $\text{Area} = D^2 \left\{ \frac{\pi}{4} - \frac{4}{3} \left(\frac{h}{D} \right)^2 \sqrt{\frac{D}{h} - 0.608} \right\}$ Where "D" is the diameter of the circle and "h" is the height of the remaining segment. In the present case "D" is the inside diameter of the boiler and "h" is the height of the steam space. (Fig. 1.)

To require the solution of the expression given above for the area would be a fatal defect in a method pretending to practical application. To avoid this the curve in the accompanying chart has been arranged.

If the expression $\left\{ \frac{\pi}{4} - \frac{4}{3} \left(\frac{h}{D} \right)^2 \sqrt{\frac{D}{h} - 0.608} \right\}$ be represented by "F" the formula for the area becomes Area $= D^2F$. This factor F, by which the square of the diameter is multiplied to give the area, is dependent only on the ratio $\frac{h}{D}$; a curve can therefore be drawn representing the relation between

the value of the factor and the ratio $\frac{h}{D}$. In Fig. 1 such a curve has been drawn with the values of $\frac{h}{D}$ between 0 and 0.5 as abscissæ, and the corresponding values of the factor F as ordinates. By the use of this curve then, the area of any segment of a circle can be readily found.

The area of the water section having been determined by this means, the weight of an inch length or a foot length is readily found. The area being D^2F square inches, the weight of one inch length is 0.036 D^2F pounds, and the weight of one foot length is 0.432 D^2F pounds. To save trouble the values of D^2, 0.036 D^2 and 0.432 D^2 have been worked out for values of D, advancing by two inches between 24 ins. and 88 ins., and are given in Table A. The process outlined above gives the weight of water in the waist, supposing there are no tubes. The weight of water displaced by the tubes is readily found from Table B, which gives for tubes of various diameters the weight of water displaced respectively by one foot and one inch of tubes of various diameters.

It now remains to find the weight of water surrounding the firebox. To do this without a laborious calculation the volume of water is estimated by multiplying the heating surface of the firebox by the mean thickness of the surrounding water space, and making due allowance for the water displaced by the staybolts. If the heating surface is given in square feet and the mean water space thickness in inches, their product multiplied by the proper factor from Table C gives the weight of the water in pounds. This added to the weight found for the water in the waist gives the weight of the total water capacity of the boiler.

Table A.

D	D^2	$0.036D^2$	$0.432D^2$
24	576	20.74	248.8
26	676	24.34	292.0
28	784	28.22	338.7
30	900	32.40	388.8
32	1,024	36.86	442.4
34	1,156	41.62	499.4
36	1,296	46.66	559.9
38	1,444	51.98	623.8
40	1,600	57.60	691.2
42	1,764	63.50	762.0
44	1,936	69.70	836.4
46	2,116	76.18	914.1
48	2,304	82.94	995.3
50	2,500	90.00	1,080.0
52	2,704	97.34	1,168
54	2,916	105.0	1,260
56	3,136	112.9	1,355
60	3,600	129.6	1,555
58	3,364	121.1	1,453

Table A—(Continued).

D	D^2	$0.036D^2$	$0.432D^2$
62	3,844	138.3	1,661
64	4,096	147.5	1,769
66	4,356	156.8	1,882
68	4,624	166.5	1,997
70	4,900	176.4	2,117
72	5,184	186.6	2,239
74	5,476	197.1	2,366
76	5,776	207.9	2,494
78	6,084	219.0	2,628
80	6,400	230.4	2,765
82	6,724	242.1	2,905
84	7,056	254.0	3,048
86	7,396	266.3	3,195
88	7,744	278.8	3,345

TABLE B.

Table B—Weight of Water Displaced by Tubes.

Tube Diameter.	Weight of Water Displaced. Per inch.	Per foot.
1¼"	0.063	0.763
1¾"	0.096	1.04
2"	0.113	1.36
2¼"	0.143	1.72
2½"	0.177	2.12

TABLE C.

Table C—Factor for Determining Weight of Water Surrounding Firebox.

Pitch.	Staybolt Diameter. ⅞"	1"	1⅛"
4 ins.	5.05	5.00	4.94
4¼	5.07	5.02	4.97
4½	5.08	5.04	4.99

As stated at the outset the method is an approximate one, and this must necessarily be the case if the result is to be arrived at by a reasonable amount of calculation. It is, however, easy to see what assumptions are made, and thus to determine the measure of confidence of which the method is worthy. In the first place an assumption is made tending to give too heavy a result. In estimating the weight of water in the waist, the whole distance between tube sheets is taken, and in estimating the weight of water surrounding the firebox the whole firebox surface, including the tube sheet, is supposed to be overlaid with a sheet of water of the mean thickness of the water space, consequently the water between the firebox tube sheet and a vertical extension of the throat sheet is counted twice. A further tendency to an excessive result is due to the neglect to consider the water displaced by crown bars or longitudinal braces.

On the other hand, the result has a tendency to fall short, because the crown-sheet is only estimated to be overlaid by a sheet of water of the mean water space thickness, while in reality there will be considerably more water over the crown-sheet. Another item, making for a light result, is the estimation of the water by means of the surface of the inside of the firebox. Of course the surface which should be multiplied by the mean water space thickness to give the volume is a surface lying between the inner and outer surfaces of the water under consideration. There are thus two factors tending to an excess and two tending to a deficit of weight. Careful consideration has led to the belief that for practical purposes the errors may be taken to balance each other, and comparisons of calculated with actual results have gone to confirm this belief.

A concise recapitulation of the method is as follows:

If W_w = weight in pounds of water in one foot of waist,
D = inside diameter of boiler in inches,
h = height of steam space in inches,
F = factor found from curve in Fig. 1 to correspond to ratio $\frac{h}{D}$,
and A_4 = factor from column 4 of Table A, to correspond to D.

Then $W_w = F \times A_4$.

From this the weight of water displaced by one foot of the tubes (Table B) must be deducted, and the result multiplied by the distance between tube sheets in feet.*

Again, if W_s = weight in pounds of water surrounding the firebox,
S = firebox heating surface in square feet,
d = mean water space thickness in inches,
and c = factor corresponding to stay-bolt diameter and pitch in Table C.

Then $W_s = c \times S \times d$.

The total weight of water in the boiler is the sum of the two above results.

THE AMERICAN RAILWAY ASSOCIATION.

The fall meeting of this association was held in St. Louis October 23, with a large attendance. An invitation to the International Railway Congress to hold its next convention in the United States in 1905 has been accepted, and an "American Section" will be organized to make the necessary arrangements. The committee on Standard Dimensions of Freight Cars recommended the following dimensions for standard cars: 36 ft. long; 8 ft. 6 ins. wide; 8 ft. high, with a cross section of 68 sq. ft., and cubical contents, 2,448 cu. ft.; the side-door opening to be 6 ft. wide. This car is recommended to be considered the unit for the establishment of minimum carload weights, and the necessary steps will be taken in connection with the rates to discourage the building of larger or smaller cars, but the use of smaller cars, until they are worn out, is provided for. A resolution was offered as follows: Resolved, that no box cars of larger dimensions than those prescribed for the standard car shall be hereafter constructed, and that all owners and builders of cars be officially notified of the adoption of this resolution. The recommendations were adopted and as the subject is exceedingly important it will be discussed in our next issue.

Arrangements have been made (with the Aetna Life Insurance Company, of Hartford, Conn.), by Mr. J. M. Barr, First Vice-President and General Manager of the Seaboard Air Line, to furnish accident insurance to the employees of that system at a materially reduced rate. This insurance company will have the exclusive right to solicit accident insurance on this road, and payment for insurance premiums will be made from the pay rolls only for the Aetna Company. Employees preferring to insure with other companies will be required to arrange for the payment of premiums outside of the railroad company's accounts.

*The boiler is supposed to be a straight top boiler, so that for the average inside diameter, D, the outside diameter of the first ring, can be taken. For a wagon top boiler the weight of water in the cylindrical part is found as above, while for the coned part the mean weight per foot (or inch) is equal to 1/3 $(W + w + \sqrt{Ww})$, W and w being respectively the weights per foot (or inch) of the sections at either end of the cone.

EIGHTY-THOUSAND POUNDS CAPACITY TANK CARS.

For Oil or Water.

Atchison, Topeka & Santa Fe Railway.

In order to deal with the oil business in Texas and to carry water for supplying locomotives in the desert districts, the Atchison, Topeka & Santa Fe has built 450 large tank cars which have a number of new features. Their capacity is 9,406 gals. when fitted with heater pipes. One hundred of them will be used to carry water for locomotive use and the rest for service in the Texas oil-fields.

Instead of resting upon the floor of a flat car, the common practice in tank car construction, this design places the tank upon seven 8 by 9-in. white oak cradle blocks, and between two head blocks, all of which rest upon four 5 by 9-in. yellow pine longitudinal sills trussed with 1¼-in. truss rods. The general dimensions are as follows:

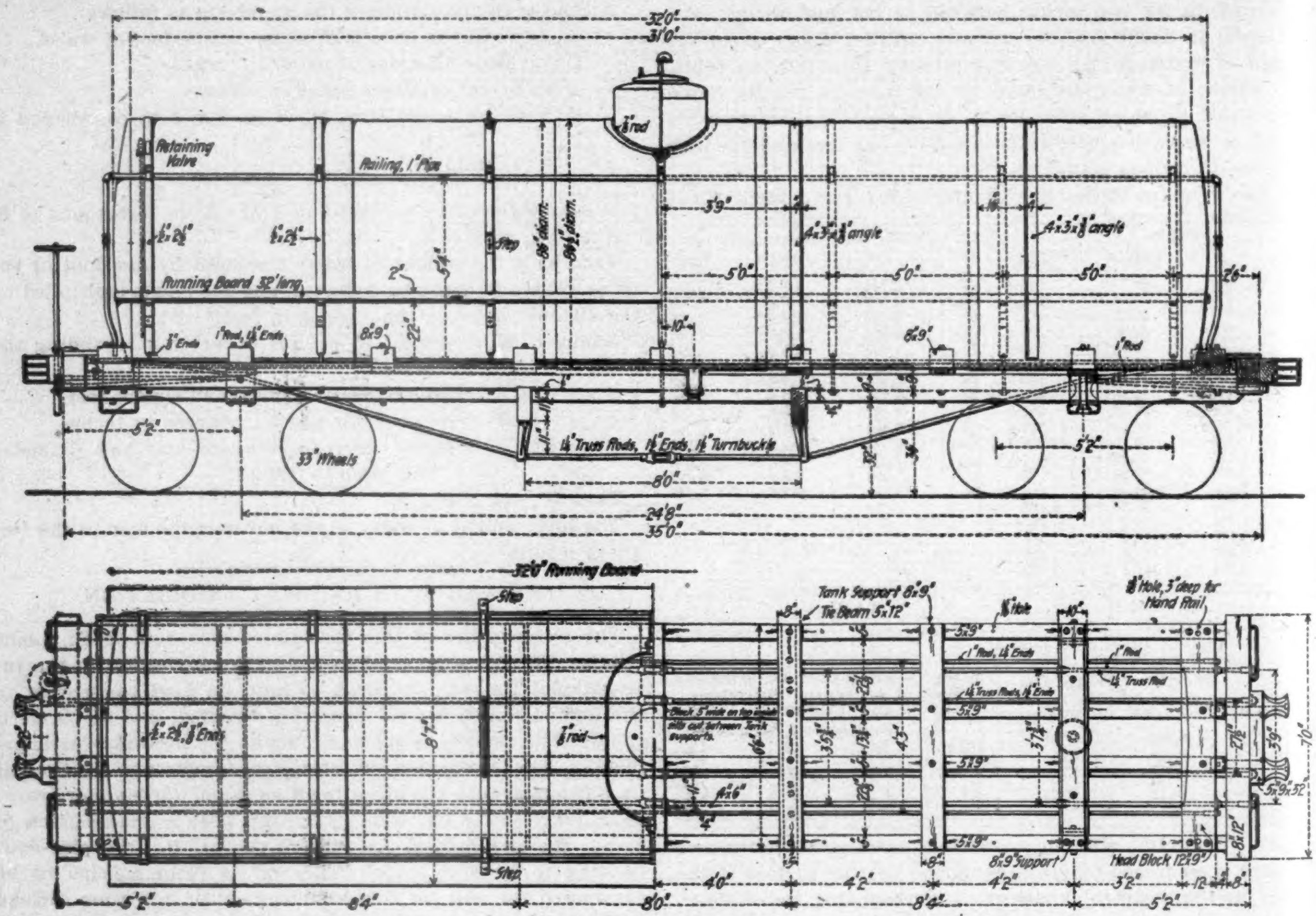
80,000-lb. Tank Car, A. T. & S. F. Railway.

Length over end sills	35 ft.
Length of tank	32 ft.
Width over end sills	6 ft. 6 ins.
Width over running boards	8 ft. 7 ins.
Diameter of tank, outside	7 ft. 2½ ins.
Height, rail to bottom of side sill	3 ft. 0 ins.
Height, rail to center of tank	7 ft. 2 ins.
Height, rail to top of dome	12 ft.
Height, rail to top of dome cap	12 ft. 5 ins.
Wheel base of car	29 ft. 10 ins.
Wheel base of trucks	5 ft. 2 ins.
Trucks, center to center	24 ft. 8 ins.
Distance between crossbeams	7 ft. 7 ins.
Capacity for oil	9,406 gals.
Weight of tank	10,000 lbs.
Weight of car body	10,700 lbs.
Weight of trucks	13,400 lbs.
Total weight, with heater pipes	35,300 lbs.

Heater pipes are necessary for carrying California oils, because they are thick at ordinary temperatures. Beaumont oil is considerably thinner, but on cold nights it becomes too thick to unload freely. A saving of weight would be possible if these pipes were omitted and if the plates were made thinner. In this one the body plates are ¼ in. and the heads and dome ⅜ in. Throughout, the rivets are ½ in., with all seams, except the dome joints, double riveted. Seven straps secure the tank to the car body. The principal timbers are as follows:

Sills, yellow pine	5 by 9 ins.
End sills, yellow pine	8 by 12 ins.
Dead woods, white oak	5 by 9 by 32 ins.
Crossbeams, white oak	5 by 12 ins.
Cradle blocks, white oak	8 by 9 ins.
Head blocks, white oak	9 by 12 ins.

The draft rigging is the Dayton twin spring arrangement, the body bolsters are of wrought iron with malleable fillers between the center sills and cast iron spacers between the upper and lower plates; the trucks are the Atchison standard Player type for 80,000-lb. cars, having 5 by 9-in. wrought iron axles, M. C. B. malleable iron journal boxes and 33-in., 600-lb. cast iron wheels. These cars were designed by the motive power department of the road at Topeka. They are being built at the shops at that point and the tanks are furnished by the Hamler Boiler and Tank Company, of Chicago.



80,000 Pounds Capacity Tank Car—Atchison, Topeka & Santa Fe Railway.

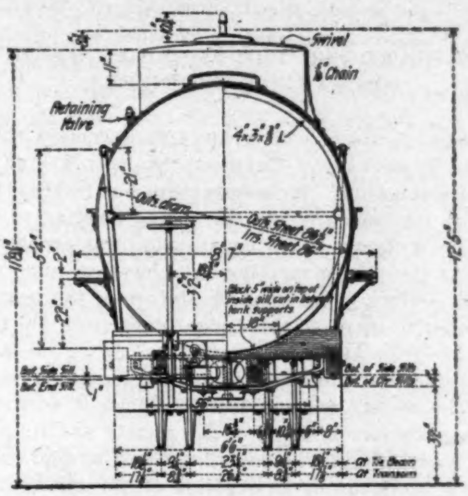
Having discovered that a statement in the preliminary article on the American Engineer tests has done an injustice to the motive power department of the Chicago & Northwestern Railroad, we hasten to explain. The indicator cards referred to on page 303 of our October issue, which show such high back pressures, do not represent the practice of that road. For a special purpose a 4⅞-in. exhaust nozzle was in the engine at the time of the tests, and for some reason was not removed before the cards were taken. The engines of this class usually run with a 5¼-in. nozzle, which would undoubtedly reduce the back pressure somewhat. We were not aware of this fact at the time, and we are glad to correct the impression which we received and probably also gave to others.

COMPOUND LOCOMOTIVES ON THE BUENOS AIRES GREAT SOUTHERN RAILWAY.

From a paper by R. Gould, read before the International Engineering Congress, Glasgow.

The question of coal consumption of locomotives becomes in countries like the Argentine Republic, which depends entirely on the imported article, a matter of paramount importance, and an endeavor to secure an economy in this respect led to the trial of the compound engine.

The type of engine adopted on the Great Southern Railway was the two-cylinder "Worsdell and Von Borries," as being the simplest arrangement, and interfering least with the duplication of parts of the standard simple engines previously in service. All these engines, both simple and compound, were



Section and End Elevation of Tank Car.

built by Messrs. Beyer, Peacock & Co., under the instructions of Messrs. Livesey, Son & Henderson, the company's consulting engineers.

The first compound engines ordered were erected in 1889, and the results obtained were so excellent that, with the exception of shunting and local traffic engines, no simple engines (either goods or passenger) have since been ordered.

The engines proved easy to handle, exhibited a high economy in coal and water, and, owing to the reduced demand on the boiler, showed less tendency to priming and scale than the original simples. As an offset against these advantages, the first compounds sometimes showed a sluggishness in starting, or an inclination to jib, due to the rapidity with which the automatic "Worsdell and von Borries" starting valve caused compounding to take place, reducing the power by cutting off the live steam from the low-pressure cylinder before (in the case of long and heavy trains) the whole weight was fully taken on the drawbars, or the whole train in motion. The defect was gotten over by an improvement made in the company's works at Buenos Aires in introducing a hollow spindle in the muchroom valve with an escape passage to the chimney, the office of the passage being to relieve the back pressure to some extent, and so delay compounding.

The effect of the alteration in the intercepting valve was to entirely obviate the tendency to jib previously experienced, and to ensure a certain and easy start, with the maximum power, while retaining the automaticity of the valve's action, a most valuable and important feature, putting it out of the power of the driver to work non-compound longer than was absolutely necessary. Some 109 engines were fitted with this improvement.

Increasing weights of trains made it necessary to do something to adapt engines—of which the company possessed a large number—to the heavier demand on their power. The boilers of some of the older engines were replaced by new and larger ones carrying high pressure, the cylinders being at the same time changed for those of increased size, and the engines compounded. The engines have proved a great success, being from 25 to 30 per cent. more powerful than the old Class 6 which they supersede. The tabular statement attached shows the coal and lubricant consumption, and also the comparative cost of repairs for the mileages given.

The absence of heavy grades on the Buenos Aires Great Southern Railway renders it a favorable field for the compound engine, the grades of importance being in one district only, the bulk of the line being practically straight and level. The character of the traffic, with long runs and full trains as a rule, causing an approximation to the fixed load of a stationary engine, is also favorable for the compound system.

CONSUMPTION OF COAL AND LUBRICANTS FOR THE YEAR 1900.

		Passenger Engine.			Goods Engine.		
		Simple	Compound.		Simple	Compound.	
		Class 6	Class 6A	Class 6B	Class 7	Class 7A	Class 10
Coal consumed per train-mile	lbs.	36.00	28.05	29.25	55.68	45.00	40 50
Average weight of trains	tons	162	166	211	624	585	526
Average number of axles per train.		25	25.5	32.5	96	90	81
Coal consumed per axle per mile	lbs.	1.44	1.10	0.99	0.58	0.50	0.50
Lubricant consumed per 100 train-miles	lbs.	7.70	6.45	6.28	7.13	7.27	5.96
Lubricants consumed per 100 engine miles	lbs.	6.38	5.96	5.96	5.57	5.96	5 32
Ratio of coal consumed per axle per mile		100	76.4	62.5	100	86.2	86.2

Cost of Repairs.

	Passenger Engine.		Goods Engine.	
	Simple.	Compound.	Simple.	Compound.
	Class 6	Class 6A	Class 7	Class 7A
Number of engines repaired	32	21	22	43
Average cost of repairs per engine per mileage shown	£510	£470	£498	£470
Average number of engine-miles run for above engine repairs	51,034	55,865	54,769	55,224
Average number of engine-miles run per annum	23.916	28,920	20,556	25,692

Speaking of the advance in locomotive building, Mr. A. B. Johnson, of the Baldwin Locomotive Works, says that in the next year or two the capabilities of the American-built locomotive will be increased from 25 to 35 per cent. He also insists that locomotive engineering on scientific principles has only just begun, and that the progress in the immediate future will result in a gain as great as that of the past 15 years. While the freight engine bids fair to continue its increase in weight, Mr. Johnson says of the passenger engines that "there will be no marked change in the external appearance. I should not like to see any great increase in weight. The beauty, gracefulness, the symmetry of the locomotive of the present will be retained. Such changes as will be made will be internal, that is, in the firebox, the boiler and the cylinders. The Vauclain compound locomotive, which utilizes some of the steam power which was once wasted, is coming into wide use. Possibly another step forward will be the addition of other cylinders for the further utilization of waste steam, and there is a constant effort to save the waste of coal energy, which is now so large a percentage of all the energy of consumed coal."

As to the further development of the American locomotive as a high-speed and high-power machine, Mr. E. P. Watson, in a recent issue of the "Engineering Magazine," expresses his opinion "that the greatest stumbling block is the line itself, as it exists on most American railways between important terminals."

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It has been said that the two big freight locomotives which have been running about two years on the Illinois Central are failures, and that the road will not build more of them. It is probably true that no more 110-ton engines will be built for this road at present, but it is not true that they have been failures or that they are now so considered by the management. In this issue the results of the road tests show the correct status of these engines. They operate more cheaply than the lighter engines, even under conditions which are exceedingly unfavorable. The real fact brought out by this experiment is that these engines outclass the conditions under which they operate. They do not get full trains because of the traffic conditions, they can haul more cars than the sidings can hold and they can shear off the heads of draft gear bolts at an amazing rate. These engines are powerful enough to expose the weak spots in the other factors of operation and to indicate that the locomotive is somewhat ahead of its surroundings. Having this valuable information, what is the proper view to take concerning large engines? They are economical when they may be loaded to capacity. A policy of gradually increasing the power of locomotives to keep pace with improvements in the condition of cars, sidings, bridges and operating methods is a good one. This subject is vitally important, and we shall soon be able to present figures to show the effect of a gradual increase in the power of the locomotives of another road which abundantly proves the big engine policy to be a good one.

Tests comparing narrow and wide firebox locomotives on the Southern Pacific are recorded elsewhere in this issue. The locomotives were both compounds of the same type and sizes of cylinders but not of the same weight and heating surface. As might have been expected, the wide firebox showed a decided advantage. In ton miles per pound of coal the wide firebox engine showed an improvement of 13.8 per cent. and 10.1 per cent. In equivalent evaporation of water per pound of coal the advantage was 11.8 per cent. and 17.9 per cent. The average of both tests show a gain of 12 per cent. in ton miles and 14.8 per cent. in water evaporated per pound of coal. To correctly estimate these results it must be noted that the condition of the track was unfavorable to the wide firebox and that engine undoubtedly used wet steam. Altogether the tests are probably perfectly fair and the wet steam and slippery rail may balance the advantage obtained from the more powerful boiler of the wide firebox engine. One cannot fail to be impressed, however, with the necessity for great care in estimating the value of test records from locomotives which are slightly different in important particulars. In this case the difference of a few inches in the distance between the water line and the throttle valve opening has an important effect which cannot be correctly estimated without a calorimeter and a very elaborate series of experiments. But we have the assurance of the engineer who conducted the tests that the comparison given in the table of results is correct. This is the first instance of tests of this kind showing the value of improved fireboxes for soft coal, and we are glad to be allowed to present the record. The value of the wide firebox seems to be in the less vigorous rate of combustion. It is specially interesting to note the effect in the accumulation of cinders in the front end.

A NEW HOUSE FOR THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

With twenty years of conservative management the American Society of Mechanical Engineers has won a high place as a technical association. Its membership has increased rapidly, and likewise its influence. At the spring meeting of this year at Milwaukee a change in the constitution was proposed which, if enacted at the winter meeting, will have an important and, it is feared, serious effect upon the future of the organization. It is proposed to increase the annual dues from $15 to $25 for members, and from $10 to $15 for juniors. In an official circular it is announced that the added funds are needed to conduct the affairs of the society without loss of efficiency and to provide for more satisfactory housing of the society and its library.

With a membership of about 2,000 and annual receipts of over $35,000, there can be no question of the possibility of conducting the business of the organization efficiently without increasing the dues. This reason for the proposed increase may be dismissed at once and attention given to the suggestion concerning larger quarters.

The mechanical engineers' house is a pleasant, home-like place, fully adequate, except on a single night of the year. At the opening session of the winter meeting it is too small. Everyone knows the effect of heavy indebtedness on a society of this kind, and to blindly enter upon a long period of such pangs as a new house would bring seems, to say the least, unwise and a most uncomfortable change from the present situation.

If there were not other ways to meet the need this course might be justified, but the American Society of Civil Engineers has recently built an admirable house, and that, too, is used to the full capacity seldom, if at all. What is really needed is a meeting place for engineers, a house with the necessary facilities, which, by reason of the number of tenant societies, would not represent such extravagance and wastefulness. Engineers more than any other class of men should appreciate the "low efficiency" of plant of these two national societies, and they will be quick to see the advantage in a joint building. The Institute of Electrical Engineers must soon secure permanent quarters in order to accept the gift of the Latimer Clark library, which was donated on condition that a suitable place shall be provided for it. There seems to be no reason why these three societies should not enter into a tentative arrangement pending the adoption of a plan for a new house in which the libraries, reading rooms, auditoriums and administration offices may be concentrated or combined. Such a building would be invaluable as a meeting ground for engineers, and doubtless other smaller societies would be glad to have the use of it.

A tenant society in the building of another society never feels at home, and unless all were on an equal footing the joint plan would eventually fail, but by studying the problem with a broad view of ultimately bringing engineers together in their separate organizations, a satisfactory scheme should be found. A temporary arrangement could probably be made for the use

of the civil engineers' house, and if it was understood to be temporary it ought to work well. It is probable that the advantage of a joint building would soon appear to all in a favorable light, which would be a good starting point for the future. There can be no question of jealousy in such a case with such men. The value of a concentration (we do not say consolidation) of the libraries concerned and the improvement of their administration, seems sufficient to insure consideration to this arrangement. If the building of the civil engineers is found to be too small, and if it cannot be extended, the associations can then take up the problem in its broadest phase.

There is an element of injustice in the proposed increase of dues, in that the burden will fall on all members, while few will be able to obtain any direct benefit. If dues, already heavy, are increased, the society will be likely to lose many helpful members. Undoubtedly, it will tend to keep out many young men who are growing up into the profession, and this the society cannot afford to do.

Where the expenses are so heavy in proportion to the benefits every effort should be made in the direction of increased efficiency. The proposed plan of joint division of this expense presupposes the co-operation of the various societies. Whether this can be secured is not known, but it should be known before another society builds a home for itself alone. It is to be hoped that conservative counsel will prevail when this question comes up in December. It is impossible to believe that such an increase can be passed by a two-thirds vote at the annual meeting.

THE BUSINESS PROBLEM IN CAR CONSTRUCTION.

Until a few years ago car construction was one of the rough and ready arts, in which the sizes and arrangements of parts followed well established precedents, and a thorough knowledge of the exigencies of service, coupled with good judgment on the part of the builder, were all that were required. These attributes are not less necessary now that new conditions have come into the car situation, but the men who have brought car practice up to its present state find new problems which do not yield to the established methods. One of the new conditions is brought into prominence by improved operating methods which render the dead weight of the car noticeable in the financial returns. In some kinds of service this is not yet considered important, but it is evident that one of the problems of the future in this field is to produce the lightest cars which will have the strength and endurance necessary to withstand the punishment of service.

For about three years this subject has been carefully studied, and the effect is indicated by the number of applications of engineering principles to car design which are now undergoing service trials, for steel car construction cannot yet be considered as crystallized. This is a most interesting and promising stage in the development of cars, and much is to be expected of the next few years. The idea of utilizing the weight of every possible part for assisting in carrying the load has only just begun to be applied to steel cars, and this is believed to be one of the most important directions which future development can take. This is the factor in car design which offers ultimately the greatest savings possible in the operation of trains. It is intimately associated with the power and weight of locomotives, and consequently the weight of rails and strength of bridges. In spite of all that can be done to favor the locomotive, it is absolutely certain that present indications point to still heavier ones as a business necessity. This increase, however, cannot go on indefinitely. Just now it is easier to build heavier locomotives than to favor present ones by more favorable conditions, but these conditions must eventually receive attention. This applies to passenger as well as freight service, for we have now the suburban locomotive developed to a weight on driving wheels greater than the total weight of the heaviest passenger locomotive of but ten years ago, and we have freight engines now running weighing 230,000 lbs., with much heavier ones suggested, and now in the drawing room stage. There is "money" in big engines, as records from the Illinois Central published in this issue and other records still to come, indicate; but there is, perhaps, even more in lighter cars. In view of these facts every effort toward improvement in cars should be considered as an important step in advance.

In this issue is illustrated a new car designed by Cornelius Vanderbilt, which embodies one of the boldest steps ever taken in the direction which is considered so important. These cars have no underframe whatever, in the usual acceptance of the term. They have center sills, but light ones, only to provide for the draft and buffing stresses. They have no side sills, the weight of the car body and load being carried by the trussed sides and transmitted directly to the bolsters by the vertical struts of the side trusses, which are placed at the bolsters for this purpose. Trussed side frames have been used before, but never in such a way as to permit of taking advantage of the full length from the bottom of the hoppers to the top rails for obtaining trusses of the maximum possible depth. The performance of these cars in service will be closely watched. They are likely to mark a departure in steel car design.

THE DUTY OF THE OFFICER TO HIS MEN.

It is comparatively easy to direct and control the forces of nature, to build monumental engineering works, and little wonder is expressed over the greatest undertakings of this character. Much has been written concerning these things. The transactions of technical associations are filled with papers and discussions concerning them, but comparatively little has been written about men, without whose loyal assistance these works could not be accomplished. Mr. S. P. Bush read a paper before the Western Railroad Club last month in which very important suggestions were presented on the subject of men. It is one of the most important papers in the records of that club.

The development of young men to take responsibility is one of the most difficult, and yet one of the most important, duties of an officer. Even those who observe without being actually concerned in the problem can perhaps appreciate the need, if they are unable to suggest methods.

Recently, in a large manufacturing establishment, a man was needed for special duty which required a peculiar experience. Fortunately this concern made a practice of keeping a careful record of the experience of every promising employee, and a man was found in the drafting room who had all of the necessary qualifications. It hardly needs to be said that this selection was wise, and that it was good business policy. In another drafting room six places were made vacant in two months because the salaries were lower than the prevailing rates. This was on one of our most prominent railroads.

Mr. Bush speaks of "voluntary loyal effort," which counts for more than anything else in large organizations. It seems reasonable to expect a corps of men to give more loyal and unstinted service to their employers when working in an atmosphere of encouragement than when they are discouraged or disheartened. An organization which is self-sustaining by the advancement of its own members whenever an opportunity offers, is likely to secure this loyal effort. A systematic method of giving credit for suggestions and improvements is not as common as it ought to be. In the headquarters of a department recently visited an unusual example was found. For years the head of the department has kept in a book a record of the valuable suggestions offered by his subordinates. This book was not often referred to, it is true, but its existence was encouraging to the young men, who fully appreciated the fact that credit was given them for their faithfulness. This practice enlisted efforts which otherwise would not have been made.

The best men are always wanted in emergencies, and railroad work is full of emergencies. At these times a thorough ac-

quaintance with the subordinates is needed. A well-known railroad officer recently applied to us for a man for an important position, and was surprised and somewhat chagrined when one of his own men, just the one for the place, was suggested. The appointment was made, and it resulted most satisfactorily.

Many officers are not entirely satisfied with their assistants, and while there are some cases occasionally requiring "new blood," there are many others which may be improved, if not entirely corrected, by the exercise of painstaking assistance from the superior. Men do not always know how to find their own best fields, but a little effort and kindly interest may set them right.

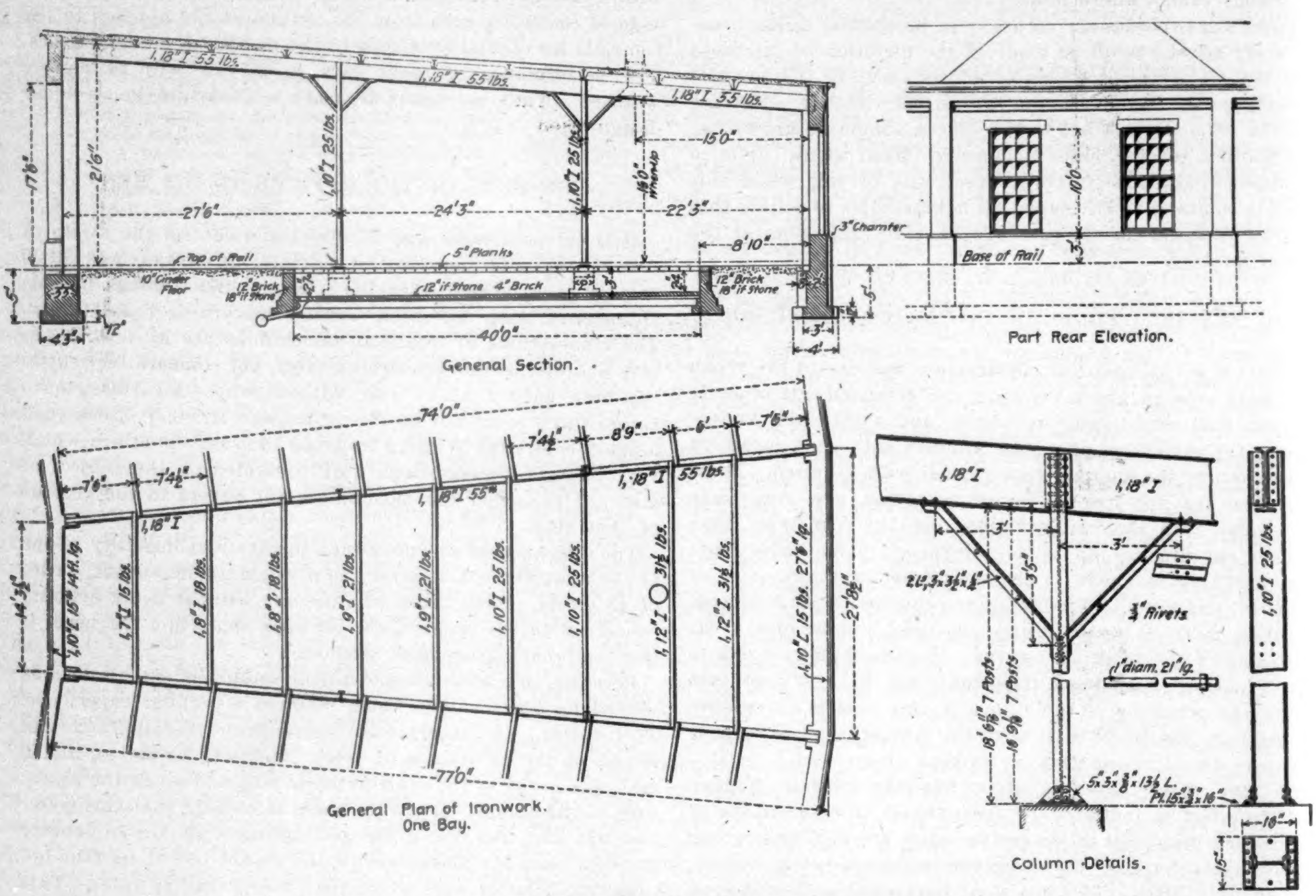
Mr. Bush emphasizes the importance of the duty of the leader to set an example to his helpers. He says: "Among organizations as large as are often found in the railway mechanical department it would seem that enthusiastic and loyal effort must be a most important factor. But surely the moving spirit in bringing about such a condition, like water, cannot be expected to run from a lower level to a higher one; it must start from the higher one. This is the problem which we generally call the 'handling of men.'" It applies to the leader of thousands of men, and to him who has only one.

Mr. Lucius B. Sherman has resigned as Western Manager of the "Pocket List of Railroad Officials," a position which he has held for the past five years, to become Western Manager of the "Railroad Gazette," with headquarters in the Monadnock, Chicago. Mr. Sherman has had a wide experience in newspaper work, and is one of the best and most favorably known of the advertising solicitors connected with the railroad press. The American Engineer joins his many friends in wishing him success in his new field.

FIREPROOF ROUNDHOUSES.

Canadian Pacific Railway.

By courtesy of Mr. Tait, Manager of Transportation, and Mr. Peterson, Chief Engineer of the Canadian Pacific, the drawings of their new fireproof construction for roundhouses have been received. There is no wood about the building except the 5-in. plank floor at the pits and the mouldings at the edges of the roof; it is therefore really fireproof. This particular house has eight stalls, but the same construction would apply to larger ones. The foundations are of stone and the pits may be of either stone or brick. If of stone the pit walls are 18 ins. and if of brick 12 ins. Either brick or stone may be used also for the outer walls.



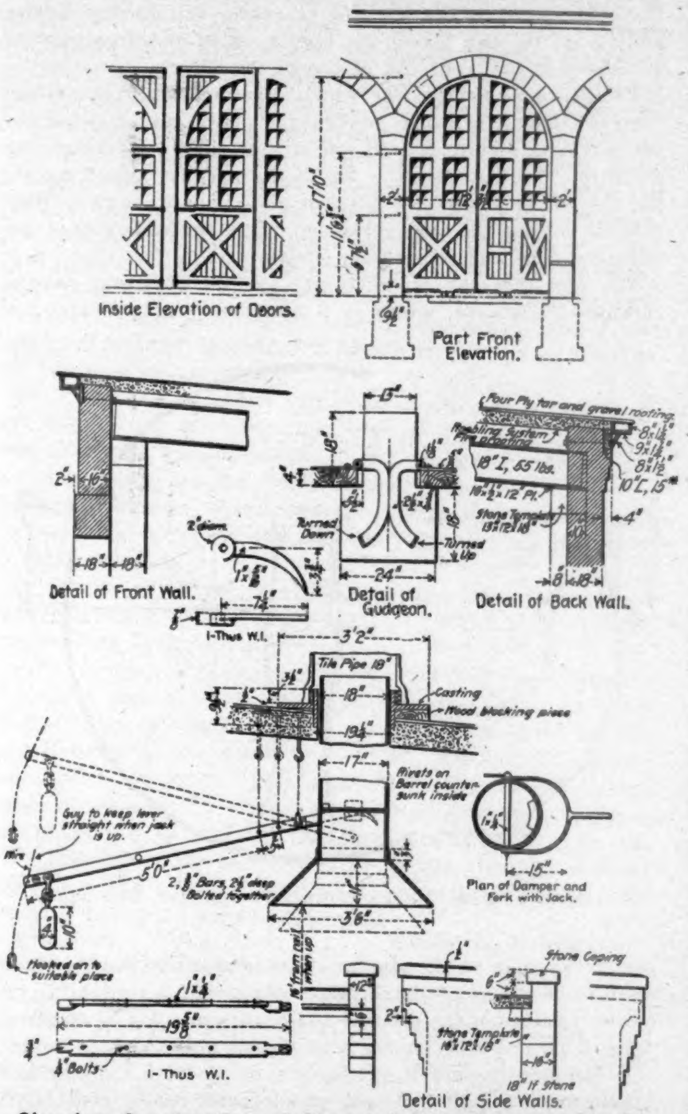
Fireproof Roundhouse—Canadian Pacific Railway.

Large sections of rolled shapes are used for the posts and roof beams, and upon these the roof of Roebling fireproofing is laid and covered with four-ply tar and gravel roofing. In the detail drawings the construction is clearly shown. It will be noticed that the roof members resting on the 18-in. I-beams are 7-in. I-beams at the turntable end of each section of the building and increased to 12 ins. at the outside where the span is longer. Tile pipe is used for the top portions of the smoke jacks, the lower portions, which are telescopic and movable, being of riveted sheets mounted on counterbalanced levers with three locations of the fulcrums to accommodate different lifts. A damper is placed near the bottom of the movable portion and the arm attached to the spindle engages with the roof casting or a bracket suitably placed on the roof. Except at the pits the floor is of cinders 10 ins. deep. The pits are 40 ft. long and extend to within 8 ft. of the outer wall.

ALUMINUM THERMIT.

Dr. Goldschmidt's simple process of welding, by means of his aluminum thermit, continues to attract attention abroad. "Engineering" recently described a public demonstration by the discoverer.

A mixture of powdered aluminum and iron oxide constitutes the thermit, which is kept in soldered boxes, and can be bought at the rate of less than 25 cents per pound. This mixture is perfectly harmless, and molten iron may be poured into it without starting any reaction. If, however, a primer, consisting of powdered aluminum and some peroxide, is applied the reduction commences at once. This was the first experiment. A little of the ignition powder is dropped into a crucible and lighted with a common fusee. It flares up, and when thermit is gradually added, the whole mass begins to boil. A minute, or less, later, the fused alumina, which floats on the top, may be poured off, and the molten iron then made to follow. To show the intense heat, a bottomless crucible was placed on the top of an iron plate ½ in. or more in thickness. The reduced iron bored a hole through the plate so quickly that the plate could be handed round before the heat had spread to the edge. Then two tubes, 2 in. in diameter, were welded together endways, a box of sheet iron being loosely fitted round the joint, and another box, packed with sand, outside this. In this case the heat alone acts, the reduced iron is not wanted really. Therefore, some of the alumina is poured out first and directed against the tubes, surrounding them with a protective layer of this oxide. After a minute the bolts which clamp the tubes together are tightened by, perhaps, ⅛ in.; a minute or two later the box frames are knocked off, and the iron and alumina also come off neatly without the slightest trouble. A beautiful weld results. An experiment with a larger tube was equally successful. Then two heavy tram rails were welded together. Boxes packed with sand had been placed about them, and the rails were held in position by two bolts, one on each side. Above the joint stood a crucible, taking about 25 lbs. of thermit and closed below by a thin plate of iron. In this instance, a little ignition powder was simply sprinkled on the top of the thermit and lighted in the usual fashion by means of a fusee. The mass soon burned its way through the under plate, and a minute or so afterward the bolts could be tightened. That practically finishes the weld. As no fishplate nor drilling is required, the Allgemeine Thermit Gesellschaft, of Essen, can weld rails on the terms usually paid for making a good joint. The process has been adopted in a good many towns, and has given great satisfaction. Some fine specimens of work done by aluminum thermit were exhibited, among them a welding of cast iron and steel, and many test bars, none of which had in the testing machine ever given way at the joint. The aluminum applied is commercial aluminum of American and other works, of 98 per cent. and more. The powdering and mixing, the manufacture of the partly magnesia-lined crucibles and box frames are all done at the Essen Works. The alumina, which results as a by-product, is an exceptionally pure corundum, which is sold to emery works. Messrs. Fox, Thicknesse, and Hull, of 32 Victoria street, S. W., are representing Dr. Goldschmidt in the United Kingdom.



Showing Construction of Fireproof Roundhouse—Canadian Pacific Railway.

ARRANGEMENT OF TOOLS AND ROOMY SHOPS.

From a paper by William Thompson, read before the International Engineering Congress, Glasgow.

The questions of arrangement of tools and roomy shops are closely connected and interdependent, and where these have to be applied to existing buildings they become very difficult ones to settle, and in most cases the result cannot be anything more than a compromise. The question of handling material, which is the direct result of the arrangement of tools, is one which has not received the attention it deserves, simply on account of the difficulty of getting at the direct loss caused by a poor arrangement. As an example of what can be done by the consideration of these questions, it might be mentioned that after the author's firm laid down their new boiler shop, the work turned out by the light and heavy plating squads was done in 19.6 per cent. less time in the new shops than it had averaged in the old, while the machines turned out their work in 10 per cent. less time than before; the conditions in both cases as regards tools and appliances being exactly the same, except that more room was allowed.

Another example taken from the machine shop illustrates this same point very well. A group of three machines was located in the old machine shop in somewhat cramped and inconvenient position, but afterward these machines were shifted to a new machine shop and given lots of room. The results of this new arrangement are given below in the annexed table:

Machine.	—Saving— Time. Per cent.	Money. Per cent.	Output increased by Per cent.
Double-headed Horizontal Borer....	3.9	2.5	4
H. and V. Planer..................	22.5	14	29
Connecting-rod Lathe	12.8	8.3	14.7

In this comparison the conditions were as nearly as possible the same in both cases, the machines doing the same kind of work; the same men were at the machines, and were working under the premium system in the new shop as in the old. The result was that the men made on an average—which is taken over a long period in both cases—9.3 per cent. more wages; the work was 8.3 per cent. cheaper to the firm, and 15.9 per cent. more work was got out of the same machines, due entirely to a better arrangement and more roomy location of these machines.

CORRESPONDENCE.

THE AMERICAN ENGINEER TESTS.

On Locomotive Draft Appliances.

To the Editor:

I have read with much interest your article on locomotive draft appliances in the October issue of your paper, and wish to join the hearty congratulations of the thousands of readers of the American Engineer in this country and abroad on the happy thought of undertaking such useful and urgently needed tests as you intend to make.

There is little doubt that the locomotive front end problem is one of the most important of those that confront the up-to-date locomotive designer. The proper function of the exhaust is so closely connected with the successful and economical performance of the boiler and of the work of the steam in the cylinders that a clear and definite knowledge of its relation to both becomes more and more necessary.

The 1896 experiments of the American Railway Master Mechanics' Association and the Von-Borries-Troske experiments of 1894, while exhaustive in themselves, have covered but a portion of the ground connected with the blast apparatus. The former have investigated the nature of the exhaust vacuum of smoke boxes, different forms of nozzles and stacks, and their relative sizes and position. The latter have been confined to the size of nozzle, distance of nozzle from stack and form of stack. While the information obtained by those tests was definite at the time and was successfully applied in actual practice on engines of that time, it is questionable whether one can be safely guided by those results in relation to modern locomotives. Besides, neither of those experiments have looked into the relation of the exhaust to the proportions of the boiler, condition and particular construction of the firebox, and to compound working of the steam in the cylinders. With the general adoption of the wide grate, the use of the 19-ft. tube in our boilers, and with 20-ft. tubes in prospect, with about 50 per cent. of compound locomotives in actual service, which per cent. is increasing in a much greater ratio, it becomes opportune to investigate the draft appliances on new lines to suit new conditions.

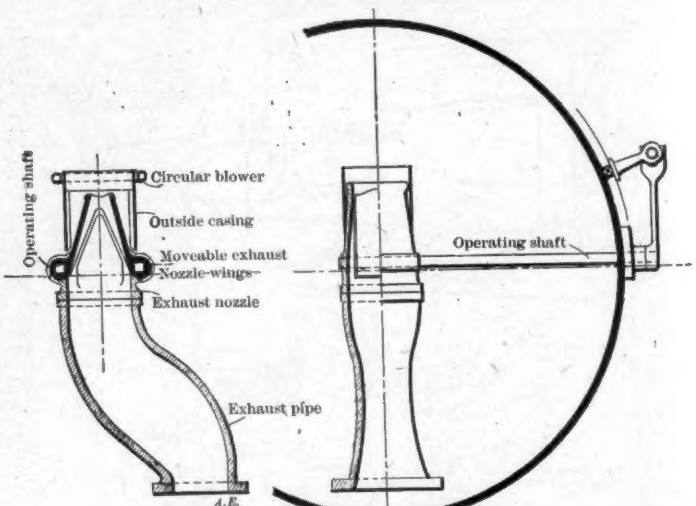
It would seem that the above-mentioned elements of the locomotive are certain factors which should enter in considering the problem of exhaust nozzle proportions and efficiency. With this point in view, may I make some suggestions?

The best proportioned nozzle, in both size and form and proper position within the smoke-box, would be such that it should produce a draft sufficient to maintain an active combustion in the firebox and would offer the minimum back pressure in the cylinders. It is to be hoped that the American Engineer Tests will prove for the first time that there is a definite relation between the area of the exhaust nozzle and the length of tubes and their cross-sectional area, as well as to the cylinder capacity. It will be evident that the temperature of the smoke-box gases escaping through the long tubes will be lower than from the short tubes, given the same activity of combustion in the firebox. What should be the intensity of the exhaust compatible with the utmost economy in either case? As the size of nozzle largely determines the intensity of the exhaust, what should be the relation between the size of nozzle and length of tube? It has also been shown that the influence of the exhaust on the firebox efficiency is very great. To illustrate the point, assume an exhaust nozzle that would work most satisfactorily and economically with a firebox having a firebrick arch, will it be wasteful in fuel consumption with the same style of box, but without an arch? What should be the size of the exhaust nozzle for wide and narrow fireboxes, and for a given intensity of combustion and when burning soft or hard coal? The efficiency of the exhaust has a close relation to the general efficiency of the boiler, and the above factors should therefore be considered in connection with the front end problem.

The height of nozzle or its relation to the stack has been exhaustively treated in both of the above-named experiments, but in neither has there been any mention made regarding its distance from the front flue sheet. I know of at least one road where the practice is to place the exhaust nozzle and center line of stack as near the front flue sheet as possible. The mechanical officers of that road claim increased efficiency of the exhaust, without increasing the back pressure in the cylinders. It often necessitated the bending of the exhaust pipe. The smoke-boxes in question are of the extended type, have no deflector plate; the height of exhaust nozzle is about the center line of the top row of tubes, and having a wire netting across and above the nozzle, extending from end of flue sheet to the front end of the smoke-box.

Another arrangement for which great efficiency is claimed (recent German practice) is, like the above case, placing the exhaust nozzle quite near the front flue sheet and extending a circular netting from the top of the exhaust pipe flange to the base of the stack. No deflector plate is used, nor any other netting besides the one mentioned. The smoke-box is of the extended type and of medium length.

The fact that the pressure and amount of steam passing through the exhaust nozzle in a compound locomotive is less



Variable Exhaust Nozzle—French 4-Cylinder Compound Locomotive.

per stroke than in the similar simple expansion engine would seem to be of enough importance to warrant investigating the proper relation of the exhaust nozzle to compound locomotives, apart from the experiments with the simple expansion engine.

It has been the practice, I believe, to proportion the exhaust nozzle for two cylinder compound locomotives by considering a pair of simple expansion cylinders that would develop the same amount of work as the two-cylinder compound. Is this safe practice? What data do we have to warrant that such proportions give the most desirable results? The same would apply to all types of four-cylinder compounds. Another point that occurs to me to be worthy of consideration in connection with the front end problem for compound locomotives is the varying pressures and quantity of steam that passes through the exhaust nozzle under different condition of service. All modern two-cylinder compound locomotives have a separate exhaust for the low-pressure cylinder, and the working of both cylnders in simple expansion is often resorted to—for instance, in starting a train from a state of rest, or when crossing difficult sections of the road, it is desirable to prevent "stalling" of the engine, or in case the high-pressure cylinder or any part of the mechanism pertaining thereto is disabled. Will the exhaust nozzle proportioned for the normal working of the engine be as efficient as when working both high and

low-pressure cylinders in simple expansion? How are we to determine the best medium? All successful compound locomotives of the two, three and four-cylinder types used to-day, and those that will come in the future, have a separate exhaust for the low-pressure cylinder or cylinders, for the reasons above mentioned? What should be the proper relation of the exhaust nozzle area to that of the cylinder capacity of the engine?

I have already intimated that in the simple expansion engine and to a much greater extent in the compound, the draft that the steam has to create is not constant and varies with the rate of combustion, degree of boiler evaporation, and speed of engine. If it were possible to adjust the exhaust so as to work most economically under those varying conditions, we should have been able to obtain the maximum efficiency from our boilers and a more economical performance of the steam in the cylinders. It is probably for this reason that European practice has been for many years, notably French, to make use of a variable exhaust. The arrangement commonly used on the Continent is illustrated in the accompanying sketch. Figs. 1 and 2 show in section an exhaust pipe provided with the variable exhaust nozzle. As will be seen from the drawings, it consists of an exhaust nozzle having two movable wings fixed to its sides. The wings are shown in the closed position; when it is desirable to increase the opening of this exhaust nozzle the hand wheel in the cab is turned and spreads the operating arms or the wings to which they are fixed through the intermediate shaft shown.

French engineers believe this to be an efficient arrangement, and the higher efficiency they obtain by its use seems to counterbalance the complication. It has been in general use for many years on the Northern Railways of France, State Railways, Eastern, Western & Southern. It has also been used on different roads in Spain and Portugal and other Continental railroads.

In closing, allow me to quote a passage from the Henry* tests and study on the evaporation of the locomotive boiler and relating to the exhaust.

"The influence of the exhaust on the power of the locomotive is so great that it would seem desirable, in spite of its effect on the boiler efficiency, to make use of all appliances permitting to increase the draft, and to vary its intensity in the largest possible limits. This is the best means to give to the power of a locomotive a great elasticity (flexibility) and afford the possibility to regulate this power in proportion to the work the engine has to do at every instant. It should, however, be borne in mind not to pass a certain limit of back pressure due to the exhaust."

CHAS. M. MUCHNIC.

Fond du Lac, Wis., October 12, 1901.

THE FOUR-CYLINDER BALANCED COMPOUND.

To the Editor:

For several years the belief has been growing upon me that we ought to thoroughly investigate the four-cylinder balanced compound locomotive in this country, but I have not before seen so many advantages outlined in its favor as appear in the editorial in the "American Engineer and Railroad Journal" for October. These I do not consider as sure of accomplishment, at least some of them, but it is safe enough to state them all as inducements for a thorough trial of the idea. It is by no means certain that the matter of repairs will be as simple as you appear to believe, and the crank axle needs a great deal of nursing before it will answer for the requirements of modern American locomotives. But that these necessarily constitute unremovable obstacles I decline to believe. I am not afraid of the crank axle.

In spite of all we can do engines must be heavy, for power must be had. Instead of making them heavier we should attack the problem of getting more power out of weights which we now have, and when track and bridge construction are up to it we may begin to think of increased weights. It is not to provide for the future so much as to reduce the present difficulties that this type appears to me attractive. What we most need is to be able to build eight-wheel and Atlantic type engines which will do the work of six-coupled, ten-wheel engines as these are now built. We have not yet reached the limit of the eight-wheel engine.

If we can overcome the difficulties with crank axles and obtain satisfactory valve motion with but a single pair of valves for the four cylinders, we ought to be able to increase the present wheel weights to such an extent that we can carry 100,000 lbs. on four drivers, or perhaps 120,000 lbs., without damaging the track as much as the present weights. Experiment would determine the lengths to which this may be carried, but if we can make four drivers do the work now required of six and can make six do the present work of eight, this system will be the relief we all are seeking.

You probably know that the Baldwin Locomotive Works are now building an engine to test this principle on the Plant System. It will be watched with greatest interest.

Superintendent of Motive Power.

THE DEMAND FOR RAILROAD MEN.

To the Editor:

The article from the pen of the editor in the October number of this journal on the "Demand for Railroad Men" immediately brings a question to the mind of the reader. Why do the managers of railroad companies permit the existence of a state of affairs which brings about this demand for men of business and executive ability, without the ability to meet such demand because of insufficient expenditure of money to pay for their services? The answer comes quickly to the mind of him who has had any opportunity to observe existing condition in railroad organization. The reason is clear. It is either indifference on the part of the manager, or it is because he is not permitted to carry out what his judgment dictates to be the correct policy in the matter of salaries.

A manufacturer is willing to spend money freely to make it freely, because he is an owner or part owner in his establishment, and the worth of the services of his subordinates is of vital interest to him as one of the money producing factors of his plant. The railroad operating manager is rarely an owner of the stock of the company, and therefore does not to the fullest extent share this vital interest of the manufacturer, or if he does, he is limited in his expenditure of money in salaries for department heads and their subordinates, by the board of directors. These directors are owners, but how many of them are intimately acquainted with the practical and truly economical operation of a railroad? How many of them realize the necessity of paying well for executive ability in all departments, and how such money paid out for this ability will be returned two and threefold?

Until the owners of railroad properties become the managers of such properties themselves or bring themselves in close contact with the problems involved in the operation of them, the demand for railroad men of executive ability will continue.

How little money in proportion to the large amount which leaks out in other directions is saved by the railroad company which is close on the salary question? The general manager holds down the appropriation for salaries of department heads. These department heads in turn hold down the salaries of their sub-department heads, and the heads of sub-departments are held down on the allowed salaries to their subordinates and rank and file employees. And thus it goes through the whole line, until we have an organization of men who but poorly fill their positions, every day wasting what a competent man would save, or if filling their positions well, speedily gobbled up by either a more appreciative railroad company or a manufacturer.

A. H. W.

[A complaint recently reached us from the chief draftsman of a leading road because in eight weeks he had lost six of his best draftsmen. Inquiry brought out the fact that the salary limit for draftsmen in the motive power department on that road was but $75 per month.—Editor.]

Mr. James H. McGraw has added to his ownership of technical papers " The Engineering and Mining Journal." This journal appears in its latest issue in a new dress and promises to add attractiveness to correspond with its high standing in other respects.

*Etude Experimentale de la Vaporisation dans les Chaudieres de Locomotives. Par M. A. Henry, Ingenieur en Chef des Ch de fer de Paris, Lyons, Mediterrannee, 1894.

THE PROPERTY RIGHTS IN A TRADE NAME.

In the suit of The Babcock & Wilcox Company against the Joshua Hendy Machine Works a decree has been entered in the United States Court for the Northern District of California, as follows:

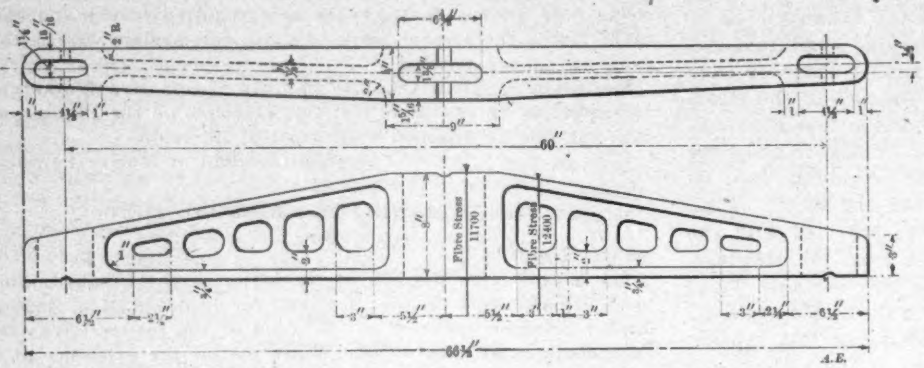
"That a perpetual injunction be and it is hereby issued against the respondent, the Joshua Hendy Machine Works, and its officers, agents, attorneys, servants, clerks and employees, enjoining it and them and each of them from using the name 'Babcock & Wilcox' either alone or combined with other word or words upon or in connection with the sale or offering for sale of any boiler or other steam apparatus not manufactured by the complainant, and from stating or representing that any boiler or other steam apparatus sold or dealt in by the respondent and not manufactured by complainant is a Babcock & Wilcox boiler, and from selling or offering for sale, or passing off any such boiler or other steam apparatus, as and for boilers or steam apparatus manufactured and sold by complainant."

An important step toward the accomplishment of the "standard box car" has been taken by the American Railway Association in the adoption of standard inside dimensions.

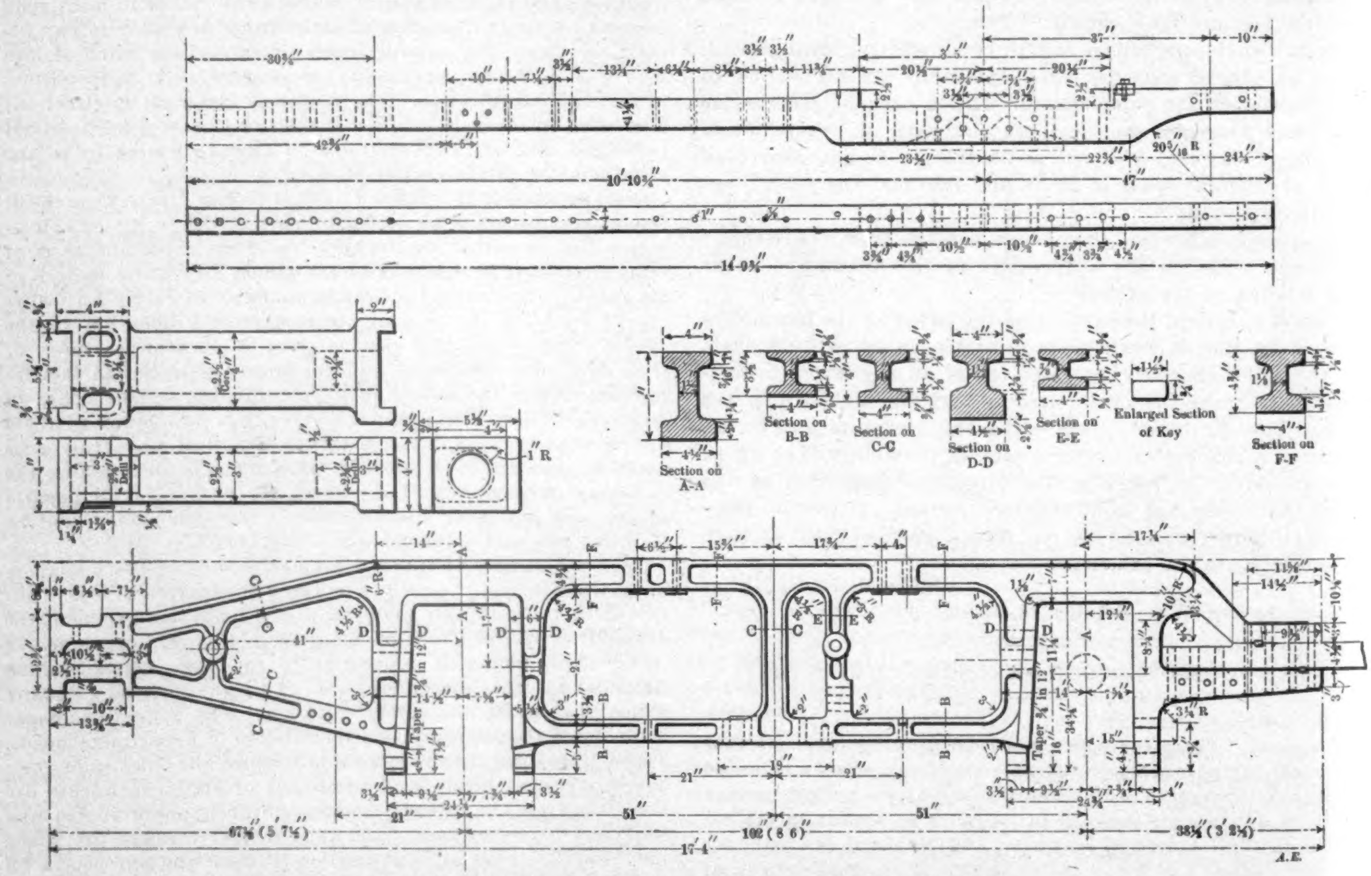
CAREFULLY DESIGNED CAST-STEEL LOCOMOTIVE FRAMES AND OTHER DETAILS.

Delaware & Hudson Company.

It has been customary to make cast-steel frames almost, if not exactly, like those forged from wrought iron. In many cases this has given entire satisfaction and in others it has not. There have been sufficient numbers of failures to draw attention to the nature of cast steel and its action in casting and cooling, and in several directions efforts have been made to design frames to suit the metal. There is no attempt to conceal the fact that the Delaware & Hudson has had trouble with cast-steel frames, the principal location of breakage being over the driving boxes. Instead of discarding this material, however, the sections were increased. There has been no trouble in welding the frames, and though the breakages have been more numerous than they should be the use of steel was continued until Mr. Slack believes he has discovered and overcome the faults of the earlier designs. All these frames are now required to be annealed, which was not done formerly. In the present design the depth over the driving boxes is 7 in.



Cast-Steel Equalizer—Delaware Hudson Company.



Cast-Steel Locomotive Frames—Delaware & Hudson Company.

In redesigning the Class V-3 eight-wheel passenger locomotive for this road, which was done by Mr. G. S. Edmonds, I-section frames were developed which are illustrated in the accompanying drawing. This is a revised design of the standard passenger engine of the road, having a Wootten firebox. The principal changes in the engine were an increase in the size of the boiler from 58 to 62 in., the use of piston valves and several other minor changes. This frame design is interesting in connection with the discussion of the subject in our issues of May, page 149, and September, page 287. Other cast steel

details of this engine are interesting, among which is the equalizer, which is also illustrated. This construction is light and with good material should be satisfactory; the fiber stress through the center at the fulcrum slot is 11,700 lbs. per sq. in. and at the first opening on either side of the center it is 12,400 lbs., under the loading given in this engine. The sling stay anchors are of cast steel and are cheaper than forgings. Mr. Slack considers them equally reliable if the metal is sound. In fact, this material is used very extensively in these engines, indicating complete confidence in it.

NEW METHOD OF CONSTRUCTING PISTONS.

Central Railroad of New Jersey.

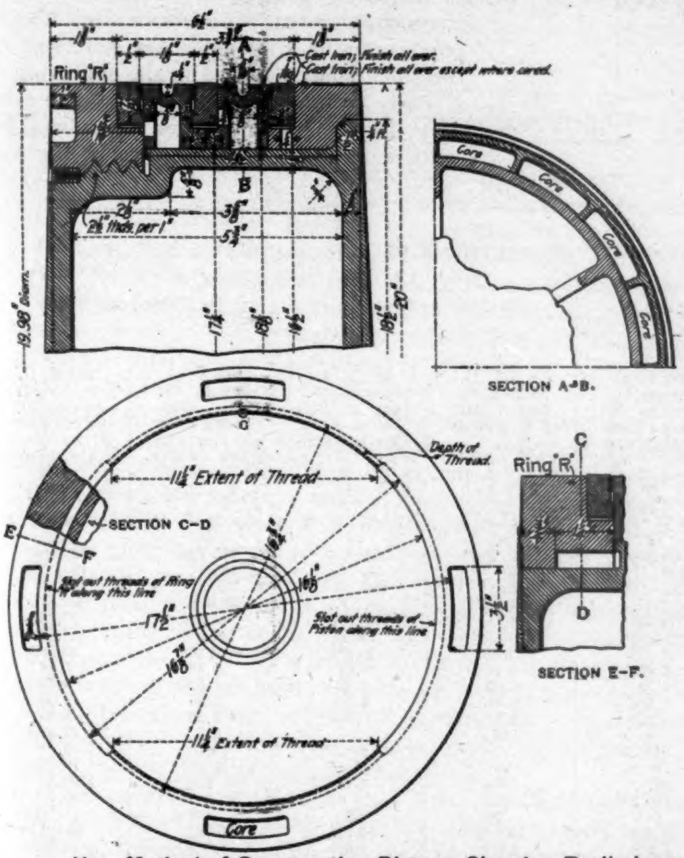
Difficulties with the usual construction of locomotive pistons were discussed at the recent Master Mechanics' Association convention by Mr. Wm. McIntosh, of the Central Railroad of New Jersey, who introduced the subject with the following topical question:

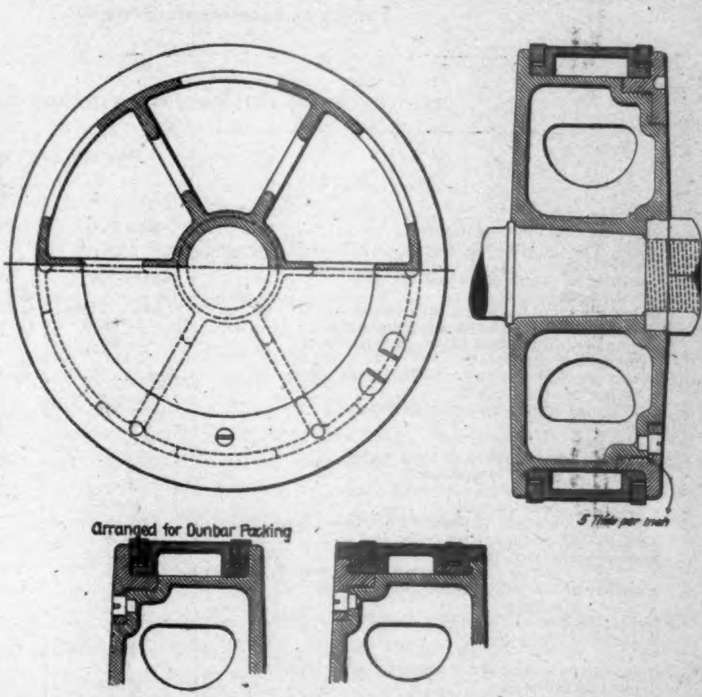
Wanted: A design of piston follower, bull ring and packing ring for cylinders of large diameter to avoid the necessity of the removal of the piston from the cylinder to change the rings, the removal of the piston on account of wear, the use of snap rings and the use of riveted followers.

Considerable difficulty had been experienced by the speaker, which was especially aggravated by the introduction of large locomotives. He said: "The piston of the solid type, equipped with snap rings, must be unkeyed from the cross-head and removed whenever necessary to change rings, and in our experience that necessity occurs quite often. If, on the other hand, it is provided with bull rings and a follower secured by plates held by bolts, there is a possibility of the bolts breaking and damaging the cylinder and cylinder heads, frequently breaking the followers and the spider or piston head also. I think all will agree that a device which will permit the easy removal of the bull rings when necessary to replace the packing would be received with pleasure, and it would seem possible that some device could be developed. With a bull ring that could be easily removed there would be no necessity for the removal of the piston head, as is the common practice with the solid head with snap rings, when it becomes worn. It would only be necessary to remove the bull ring and substitute another, when the cylinders become worn to such an extent that they had to be bored. It is possible that some such easily accessible follower is in use, but it has not come to my attention. My idea of what will constitute the most satisfactory arrangement is something similar to the breech-lock of a piece of modern ordnance."

On account of the general interest in pistons at this time we obtained from Mr. McIntosh drawings of the preliminary designs suggested by Mr. R. O. Cumback, then General Foreman, under Mr. McIntosh, and of the later development as applied to a number of large engines on that road. With this construction the bull ring and packing rings are placed and the threaded fastening ring is then inserted, turned up tight and held by a 5/16 in. set screw. The fastening ring has an interrupted thread accurately cut and extending a little less than a quarter of the circumference. It may be removed by giving it a quarter turn to disengage the threads and is then free from the piston.

On a number of roads solid pistons have been substituted for the bull ring after many years of experience. The design illustrated here will increase the first cost somewhat, but it appears to offer important advantages.





New Method of Constructing Pistons, Showing Preliminary and Completed Designs—Central Railroad of New Jersey.

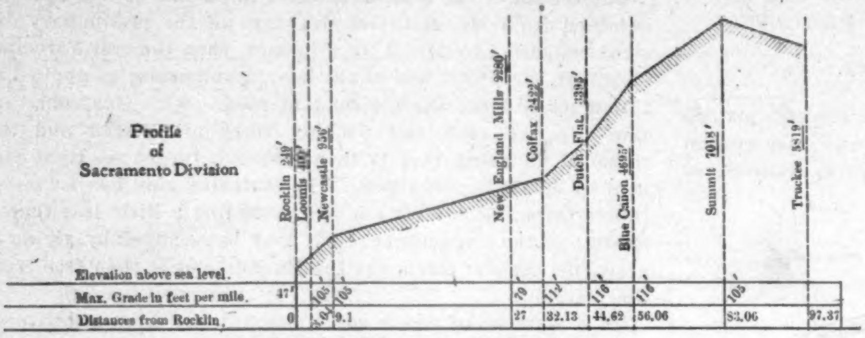
TESTS OF AJAX PLASTIC BRONZE.

Results of a test of Ajax plastic bronze, manufactured by the Ajax Metal Company, of Philadelphia, have been received. The test was made by Messrs. Hughes and Patterson, of Philadelphia, on a hot bar mill in severe service. Ajax plastic bronze was used for the bearings at one end of the rolls and phosphor bronze bearings at the opposite end. When the bearings were placed in position, November 15, 1900, they measured ⅞ in. in thickness. When taken out, February 27, 1901, the plastic bronze measured ⅝ in., and the phosphor bronze ⅜ in. On that date a new phosphor bronze bearing was applied and opposite to this the original plastic bronze bearing replaced. When compared again, April 29, the second phosphor bronze bearing was worn down to the limit of usefulness, ¾ in., while the plastic bronze still measured 7/16 in. Thus the plastic bronze showed a saving of 100 per cent. over the other metal.

TESTS OF WIDE AND NARROW FIREBOX LOCOMOTIVES.

Southern Pacific Railway.

Because of the relatively large number of moderately wide firebox locomotives built during the past year the comparison obtained in a series of road tests between narrow and wide soft coal fireboxes on the Southern Pacific will interest our readers. These figures have been received through the courtesy of Mr. H. J. Small, Superintendent of Motive Power, who has kindly sent us a report upon the subject by Mr. Howard Stillman, Engineer of Tests.



Profile of Sacramento Division.

The locomotives compared are Schenectady two-cylinder compounds with 23 by 35 by 34-in. cylinders and of the mastodon type. Two trips were made with each engine in freight service on the Sacramento Division in December, 1900, and April, 1901, running between Rocklin and Truckee. A comparison of the leading features is as follows:

Number of engine	F. C. 2,609	F. D. 2,612
Diameter of drivers, ins	57	57
Heating surface	3,027.8	3,658
Grate area	35.3	54
Heating surface per sq. ft. of grate	85.77	67.75
Weight on drivers	173,000	177,000
Size of exhaust nozzle, ins	6	6

It will be noted that the engine with the larger grate also has 631 sq. ft. more heating surface than the other engine, which probably contributes somewhat to the good showing made by the engine with the larger grate. The log of the tests is reproduced in the accompanying table, which gives the data from each run and the averages for both engines. The train weights are exclusive of the engine, tender and caboose and represent the manifest tonnage, including the resistance of empty cars. These tests were made under ordinary service conditions except as to the measurement of coal and water. An analysis of the coal gave the following:

Analysis of Coal.

	Per ct.
Moisture	3.67
Volatiles	36.74
Carbon	51.44
Ash	7.60
Sulphur	0.62
	100.00

Indicator records were taken but are not reproduced here. The distance from Rocklin to Truckee is 97.37 miles, the profile of the division being indicated in the engraving.

Clear weather prevailed in all the tests, but the track in the snow sheds was wet with melting snow in the tests of the wide firebox engine, and was unfavorable to that engine. A considerable loss of time resulted from slippery track. Tests 1 and 2 are comparable, as the trains were mixed, having both loads and empties. Tests 3 and 4 are also comparable as both had all loaded cars. In these comparisons the wide firebox shows an advantage of 13.8 and 10.1 per cent. in ton miles per pound of coal and an advantage of 11.8 and 17.9 per cent. in equivalent evaporation of water per pound of coal. The average shows 12 per cent. advantage in ton miles and 14.8 per cent. in the amount of water evaporated per pound of coal, the two results seeming to indicate a decided advantage of the wide firebox with the large grate area, because of the more moderate rate of combustion. The front end accumulation was much less

TEST OF WIDE AND NARROW FIREBOX LOCOMOTIVES - SOUTHERN PACIFIC RAILWAY.

	Rocklin to Truckee.		Rocklin to Truckee.		Totals and Averages.	
Number of test	1	2	3	4		
Number and class of engine	2609 F. C.	2612 F. D.	2609 F. C.	2612 F. D.	2609 F. C.	2612 F. D.
Area of grate surface	35.3 sq. ft.	54.0 sq. ft.	35.3 sq. ft.	54.0 sq. ft.	35.3 sq. ft.	54.0 sq. ft.
Date of test	Dec 5, 1900.	April 10, 1901.	Dec. 7, 1900	April 12, 1901.	Dec. 1900.	April, 1901.
Number of train—through freight	Extra East.	Extra East	Extra East	Extra East	Extra East.	Extra East.
Kind of coal		Castle Gate.	......	Castle Gate.	......	......
Schedule time between terminals	11 hrs. 5 min.	11 hrs. 5 min.	11 hrs. 5 min.	11 hrs. 5 min.	22 hrs. 10 min.	22 hrs. 10 min.
Total time of test between terminals	14 " 11 "	11 " 33 "	10 " 5 "	18 " 25 "	24 " 16 "	23 " 58 "
Actual running time between terminals	7 " 18 "	7 " 37 "	7 " 4 "	5 " 18 "	14 " 22 "	15 " 55 "
Time lost during test " "	6 " 53 "	3 " 56 "	5 " 1 "	4 " 7 "	9 " 4 "	8 " 5 "
Mean speed between terminals, run. time	13.4 M. P. H.	12.8 M. P. H.	13.8 M. P. H.	11.8 M. P. H.	13.6 M. P. H.	12.31 M. P. H.
Number of stops made	25	14	18	18	43	32
Maximum steam pressure (guage)	215 lbs.	220 lbs.	215 lbs.	220 lbs.	215 lbs.	220 lbs.
Minimum " " "	195 "	190 "	200 "	190 "	195 "	19[illegible] "
Average " " "	208 "	211 "	208 "	205 "	208 "	208 "
Average temperature of feed water	50.5 F.	50.7 F.	50.1 F.	53.7 F.	50.3 F.	53.7 F.
Gallons of water evaporated	18,215	18,683	17,144	19,104	35,362	37,787
Pounds " " "	151,761	155,687	142,813	159,203	294,574	314,890
" " coal burned	25,320	22,722	22,942	20,858	48,262	43,580
" " water evaporated per lb. of coal	5.99	6.85	6.22	7.63	6.10	7.22
Equivalent evaporation from and at 212° F	7.39	8.38	7.66	9.32	7.52	8.83
Engine miles run per ton of coal	7.44	8.626	8.54	9.40	8.00	8.99
" " " " 1,000 gallons of water	5.38	5.245	5.72	5.130	5.56	5.19
Number of loaded cars in train—mean	......	9	13	15	6.5	12.0
" " empty " " "	26.5	12	......	......	13.25	6.0
Total number of " " "	26.5	21	13	15	19.75	18.0
Weight of train in M s	948	987	1004	1015	976	1000.8
" " tons	474	493.3	502	507.6	488	500.4
Distance run—miles between terminals	98	98	98	98	196	196
Gross ton mileage	46,452	48,343	49,196	49,745	95,648	98,078
Ton miles per gallon of water	2.550	2.588	2.869	2.604	2.705	2.596
" " " pound of coal	1.835	2.128	2.145	2.385	1.982	2.251
Coal burned per sq. ft. of grate per hour mean for actual running time	95.33	53.87	90.74	45.16	93.04	49.52
Relative comparison between above engines in work done. Engine 2612 being considered at 100.						
Ton miles per gallon of water	98.9	100	110.2	100	104.2	100
" " expressed as gain per cent	.....	Gain 1.2%	Gain 10.2%	......	Gain 4.2%	......
" " per lb. of coal	86.2	100	89.9	100	88.0	100
Ditto expressed as gain per cent	...	Gain 13.8%	......	Gain 10.1%	......	Gain 12.0%
Relative comparison on basis of equivalent evaporation—Boiler efficiency.						
Engine 2612 F. D considered 100	88.2	100	82.1	100	85.2	100
Ditto expressed as gain per cent	......	Gain 11.8%	.....	Gain 17.9%	......	Gain 14.8%

with the wide firebox. Cinders were dumped from the front ends as follows:

Engine number	2,609	2,612
Test number	1 3	2 4
Times cinders dumped	3 6	1 1

It has already been pointed out that these engines are not exactly alike as to heating surface, the difference being much greater than the difference in the firebox areas would call for. This must affect the results somewhat. Considerable trouble has been experienced with an accumulation of water in the high-pressure cylinders, indicating the necessity for relief valves. This difficulty was greater with the wide firebox engine, and it was noted that the water line with the gauge glass half full was but 26 ins. below the lower throttle opening. With the rapid evaporation required of these engines it seems probable that the steam was very wet. In one case the indicator on the high-pressure cylinder was wrecked by water in the piping. While these factors all affect the results there is no doubt that the advantage of the wide firebox is about as indicated by this table.

THREE-CYLINDER COMPOUND LOCOMOTIVE.

A new type of express passenger locomotive, designed for a wide range of power, was put into service about two years ago, on the North-Eastern Railway of England, by Mr. Wilson Worsdell, Locomotive Superintendent of that road. This engine, No. 1,619, is so constructed that it can be run as a compound engine and as a simple engine using steam at an increased pressure in the low-pressure cylinders, and also using steam in the high and low-pressure cylinders at equal pressures. In the first case, when running compound, live steam is admitted to the high-pressure steam chests and also through a reducing valve to the low-pressure steam chests at a predetermined pressure. When running simple it is only necessary to compress the reducing valve spring which admits steam to the low-pressure cylinders at a high pressure, and by further compressing the reducing valve steam at full boiler pressure is admitted to both the high and low-pressure cylinders, in which case the high-pressure piston works in equilibrium. Between the steam ports of the high-pressure cylinders and the steam chest of the low-pressure cylinders, is placed a non-return valve, so that in starting the engine when the valve of the high-pressure cylinder is not in position to take steam, that the steam entering the exhaust ports from the low-pressure valve chest will not reverse the engine.

This locomotive is reported to be doing excellent work with the express trains between Newcastle and Edinburgh, a distance of 124 miles. The line has a number of grades, but they are not very heavy; the worst grade is the last mile from Edinburgh, which has a rise of 1 in 78. In running several slacks have to be made; in two cases the speed is reduced to 15 miles per hour, in another to 5 miles per hour and for the last 4 miles out of Edinburgh to 5 miles per hour. According to "Engineering" in an illustrated article regarding this locomotive, the mean of 15 trips run during September, 1898, gives the gross weight of each train as 404 tons, approximately, and the mean speed 50 miles per hour. On the 24th of that month the gross load was approximately 430 tons, and the mean speed 51.5 miles per hour. This is a good performance and required an average of 815 h.-p. to accomplished it. The total weight of the engine in working order is 53 tons and weight on drivers 35.5 tons. The high-pressure cylinder is 19 ins. in diameter by 26-in. stroke, while the low-pressure cylinders are each 20 ins. in diameter. The driving wheels are four-coupled and 7 ft. 1 in. in diameter. The total heating surface of the engine is 1,324 sq. ft.

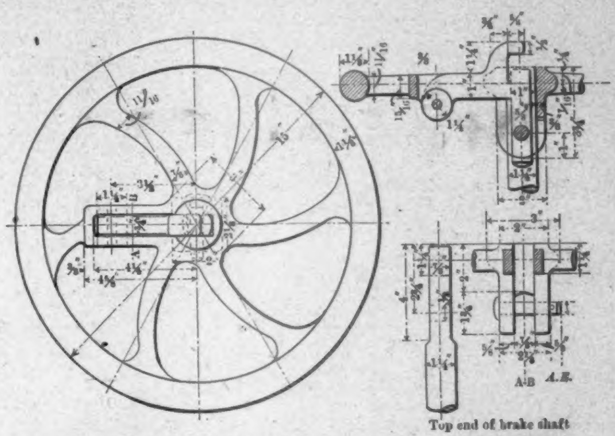
The largest order ever taken for Magnolia Metal has just been closed by Mr. H. W. Toothe with the American Locomotive Company for the supply of all the bearing metal that this company will require for the coming year.

A FOLDING BRAKE WHEEL.

Chicago & Northwestern Railway.

For use on cars of passenger trains where the usual arrangement of the brake wheel would be in the way of vestibules, Mr. C. A. Schroyer, Superintendent of the Car Department of the Chicago & Northwestern Railway, designed the brake wheel illustrated in the accompanying engraving. The wheel is turned up out of the way when the car is coupled to one having a vestibule and when in use the brake wheel is held rigidly in place.

The wheel pivots on the pin shown in section below the center of the wheel and revolves so that the left-hand side, as seen in the engraving, moves upward and to the right. The hook



A Folding Brake Wheel—Chicago & Northwestern Railway.

on the top of the dog over the center of the brake staff is used to raise the dog so that the wheel will turn up out of the way. At the last minute we note an error in the engraving. The top of the brake staff should not be shown in the dotted lines and the cross-section of the metal in the wheel should be shown against the top of the shaft so as to indicate an abutment for the wheel to rest against. To fold the wheel over, the dog is lifted and the wheel is free to move. When returned to place the dog drops into position and locks the wheel.

A GENEROUS EMPLOYER APPRECIATED.

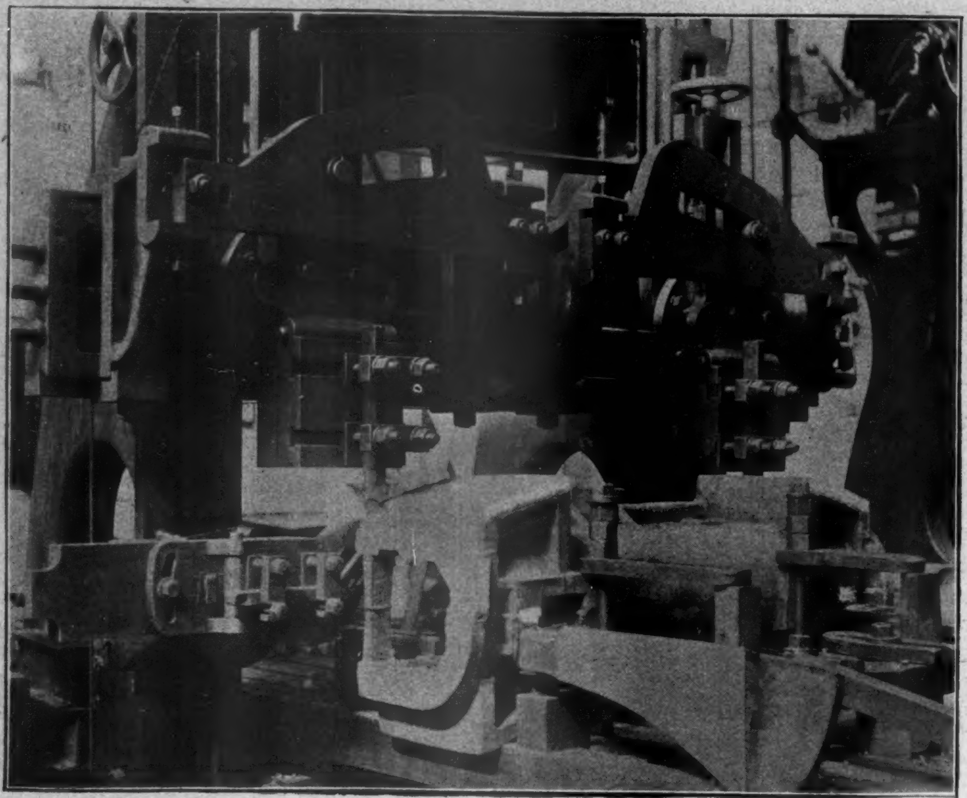
When so much is heard about the unreasonableness of workingmen the following quotation from the president of a large trust company, printed in the New York "Times," is refreshing and even reassuring, as it records a response to considerate treatment:

"When I hear discussions of the relations existing between workingmen and their employers, I invariably think of an experience my father, a manufacturer of Philadelphia, had with the men employed in a factory owned by him. At one time, some years ago, when the business in which he was engaged was being carried on with little or no profit, he continued to pay his men the established rate of wages in spite of the fact that the men employed in other factories doing the same work had had their wages considerably cut down. After this had been going on for some time he was one day waited on by a committee of his workmen, who asked to confer with him about their wages. Not unnaturally he was surprised and disappointed, believing that the men had come to make some complaint. It is easy to imagine what his astonishment was when the men informed him that they had come to insist on his reducing their wages. They said that they had been well treated in good times, and did not wish him to suffer in bad times through his generosity to them. At first he refused to make any change, but in a body they said that they would strike if he did not reduce their wages. You see, that a generous employer can find appreciation and even generosity among those whom he employs."

MACHINING RADIAL LOCOMOTIVE TRUCKS.

American Locomotive Company.

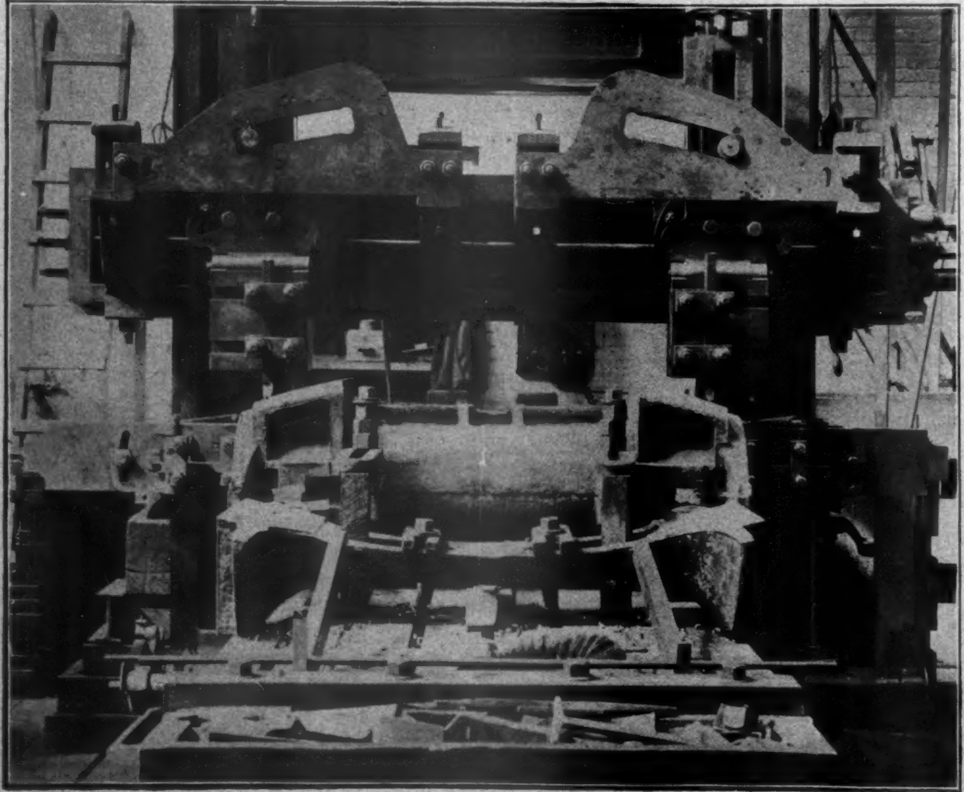
A new form of trailing trucks built at the Brooks Works of the American Locomotive Company for the Prairie type passenger engines of the Lake Shore & Michigan Southern, was illustrated on page 74 of our March number of the current volume. These trucks appear to offer advantages over others for trailing wheels because of their simplicity, and it has even been suggested that they would probably be equally satisfactory for leading trucks as well, but they have not yet been tried for this purpose.



Method of Machining Radial Locomotive Trucks.

An examination of the drawings referred to will make the construction clear at a glance. The boxes are embodied in the ends of a casting which has radial bearing surfaces between the ends of two guide castings which are bolted to the frames and have at their ends radial surfaces corresponding with those of the box casting. Some question has arisen as to the difficulty of finishing these radial surfaces and by the courtesy of the builders photographs have been received showing the method of accomplishing this.

This work is done on a Bement, Miles & Co.'s planer. The nuts for the vertical feed screws are removed and guide plates with slots formed to guide the tools to the correct radial surfaces are applied. These are shown in the photographs. When fed across, the tool posts must follow the guides or radius plates. One of the photographs shows the machining of the box. When the surface or side is treated the casting is turned over upon the guide, which is shown immediately in front of the box. The guide has already been machined and serves as a chuck for the box when turned over for the completion of its opposite side. This method insures accuracy and it greatly facilitates what would otherwise be a much more difficult and expensive job.



Method of Machining Radial Locomotive Trucks.

Trade names representing years of effort and large expenditures of money and years of experience for the development of a manufactured specialty, are of unquestioned value to the manufacturer and are important as a protection to the purchaser. It is a matter of simple justice that the property right in trade names should be protected from infringement, because the public has learned to regard the name as the designation of the source from which a manufactured article comes, rather than as a description of the article. It is cause for congratulation that the courts show a growing tendency to sustain the right of any concern to the exclusive use of its trade name as a proper designation of its product. Elsewhere in this issue is the record of an important decision of this character.

PERSONALS.

Mr. Charles Eddington has been appointed General Foreman of the Atchison, Topeka & Santa Fe shops at Trinidad, Colo.

Mr. E. H. Harriman, Chairman of the Executive Committee of the Southern Pacific, has been elected President of that company, to succeed Mr. C. M. Hays, resigned.

Mr. W. L. Harrison, formerly Superintendent of Shops of the St. Louis & Southwestern, at Pine Bluff, Ark., has been appointed Superintendent of the Locomotive and Car Shops of the Central Railroad of New Jersey, at Elizabethport, N. J., vice Mr. R. O. Cumback, resigned.

Mr. J. Kruttschnitt has been appointed Assistant to the President of the Southern Pacific, and will take up the duties of this office in addition to those pertaining to his office as Fourth Vice-President and General Manager. All officers heretofore reporting to the president will hereafter report to him.

Mr. Charles M. Hays, President of the Southern Pacific, has resigned. His resignation is due to a change in policy and organization of the company, owing to the change in ownership. Mr. Hays was for four years, up to January 1, 1901, General Manager of the Grand Trunk, which position he resigned to assume the Presidency of the Southern Pacific.

Prof. R. A. Smart has resigned his position in the department of experimental engineering of Purdue University and connected himself with the B. F. Sturtevant Company, of Boston, Mass., at the head of a department of experimental engineering which is being established for the purpose of investigating all problems relating to blower practice and developing new and more efficient applications of the fan blower in all lines of industry.

Mr. W. W. Wentz, Jr., who has been Acting General Superintendent of the Central Railroad of New Jersey during Mr. J. H. Olhausen's illness, has been appointed General Superintendent on account of the continued ill-health of Mr. Olhausen. Mr. Wentz will be succeeded as Superintendent of the New Jersey Central and Lehigh & Susquehanna division, by Mr. M. M. Richey, heretofore Superintendent of Terminals. The office of Superintendent of Terminals is abolished.

Joshua T. Brooks, Second Vice-President of the Pennsylvania, and of the Pittsburgh, Cincinnati, Chicago & St. Louis Railway companies, died suddenly at his residence in Salem, O., October 11, of Bright's disease, at the age of 61 years. Mr. Brooks was born at Salem in 1840. He entered railroad service in 1866 as solicitor of the Pittsburgh, Fort Wayne & Chicago, and the following year was appointed General Counsel for the Pennsylvania lines west of Pittsburg. He continued in this position until May, 1891, when he was elected Second Vice-President.

Mr. Charles M. Muchnic has been appointed Chief Draftsman in the motive power department of the Wisconsin Central Line, at Fond du Lac, Wis. He is a graduate of Drexel Institute, Philadelphia, and in 1896 entered the service of the Baldwin Locomotive Works as draftsman, after which he served two years in a similar capacity in the Brooks Locomotive Works. In 1899 he went to Europe and obtained a thorough knowledge of French and Continental locomotive practice. He was for a time connected with the Compagnie de Fives-Lille, and while abroad made a thorough study of the four-cylinder compound, which he has put into the form of a very interesting design of this type for adaptation to American conditions. Mr. Muchnic was in charge of the exhibit of the Baldwin Locomotive Works at the Paris Exposition.

Mr. Mord Roberts, General Master Mechanic of the Louisville & Nashville, has resigned to accept the position of Superintendent of Motive Power and Machinery of the Kansas City Southern, in the place of Mr. F. Mertsheimer, resigned. Mr. Roberts is 48 years of age, and began his railroad career with the Pennsylvania in 1867 as machinists' apprentice, and later machinist, locomotive fireman and engineer. Since that time he has been connected with the St. Louis, Iron Mountain & Southern, Missouri Pacific and Louisville & Nashville, working through the positions of traveling engineer, foreman, general foreman of locomotive shops, locomotive inspector and master mechanic. He resigned the last-named position, which was with the St. Louis, Iron Mountain & Southern, in June, 1899, and a few months later was appointed General Master Mechanic of the Louisville & Nashville, which position he now leaves for his new appointment. Mr. Roberts will have headquarters at Kansas City, Mo.

SERVICE RECORD OF FRICTION DRAFT GEAR.

The results obtained from the Westinghouse friction draft gear on the Butte, Anaconda & Pacific Railway have been reported to us from the car foreman's record, after verification by the officers of that road, and are interesting in that they support the contention that draft gear needs reinforcement in the direction of pulling or extension. It is apparent that nearly all of the breakages recorded were from pulling stresses and not from compression or buffing. This is seen in the fact that the item of yokes accounts for about 30 per cent. of the breakages. The record is interesting also because it shows that the effect of improved draft gears may be seen in a short time after its application. The report is as follows:

The Butte, Anaconda and Pacific road has 520 50-ton Pressed Steel Car Company's ore cars, all of which are fitted with the Westinghouse friction draft gear and used in ore traffic between the mines in Butte and the smelters in Anaconda, Mont. The comparative records given below are for 155 of the above 520 cars, five of which were placed in service August, 1898, and the remaining 150 in June, 1900; the remainder of the 520 cars having been placed in service more recently. The couplers on these cars have 6-inch shanks, excepting the five cars first in service, which have 5-inch shanks. One of the connecting lines of the Butte, Anaconda & Pacific has a number of similar steel cars, equipped with the ordinary twin spring draft gear (not one of the patented devices now on the market), also having couplers with 6-inch shanks, and used in the coal traffic over the Butte, Anaconda & Pacific Railway, to the smelters in Anaconda and the mines in Butte.

The record of draft gear failures and mileage made for the six months from November 1, 1900, to May 1, 1901, on 50-ton steel cars, both foreign and home, on the lines of the Butte, Anaconda & Pacific Railway, is as follows:

	No. failures.		Car mileage.		Ratio of mileage.		
1900 and 1901.	Foreign.	B. A. & P.	Foreign.	B. A. & P.	Foreign.	B. A. & P.	Remarks.
November	18	0	14,455	149,820	1	10.3	
December	20	1	17,183	146,040	1	8.4	†
January	18	0	22,356	139,800	1	6.2	
February	10	0	13,263	97,380	1	7.3	
March	13	1	11,637	131,640	1	11.3	‡
April	11	1	15,535	149,220	1	9.6	
	90	3					

†Three B. A. & P. and three foreign cars had sills damaged in a collision, and two of the latter had couplers broken.
‡Friction draft-gear cylinder found cracked two weeks earlier.

It, therefore, appears that the average monthly mileage of foreign 50-ton steel cars on the Butte, Anaconda & Pacific road

was 15,738 miles, while the average monthly mileage of the Butte, Anaconda & Pacific cars was 135,650, or 8.6 times greater. The yokes on the foreign cars were of 1-in. by 4-in. iron, while nearly all of those on the B., A. & P. cars fitted with friction draft gear were 1-in. by 4½-in. iron. Of the 90 breakages of draft gear on foreign cars, 25 were broken yokes. Deducting this number on account of yokes being unlike, there were 65 couplers and knuckle breakages on foreign cars to three on the B., A. & P. cars, or more than twenty-one times as many. On an equal mileage basis, the breakages on foreign cars were 185 times as many as on the B., A. & P. cars fitted with the friction draft gear.

The assumption is that the couplers on foreign cars were of equal strength with those on the B., A. & P. cars, and as all of the former had the extra large 6-in. shank, and, therefore, were designed for especially severe service, this assumption seems amply justified. The breakages on foreign cars were divided as follows: 35 couplers, 30 knuckles, 25 yokes; total, 90.

On B., A. & P. cars but three couplers were broken, and no knuckles or yokes, this comprising the entire breakage of draft attachments in six months' service. Compared with 35 broken couplers on foreign cars and allowing for the home cars making 8.6 times greater mileage, the breakage of couplers only, on an equal mileage basis, on the foreign cars with the double spring draft gear, was 100 times as great, or 300 couplers, instead of three, would have been broken on B., A. & P. cars had they been equipped with the spring draft gear.

The saving in coupler breakages alone in six months' service by the use of friction draft gear on 155 cars, as shown by the above record, was enough to pay the entire cost of the friction draft gear with which they were equipped, the saving in broken knuckles and yokes being additional and in the nature of an increased interest—and a large one—on the investment.

The ore service on the B., A. & P. is severe, as the grades are steep, reaching 132 ft. per mile, while the locomotives are very heavy and powerful, those used between terminals being 8-wheel connected Schenectady compounds. Trains of 50 and 60 loads are handled one way and empties the other, all the air brakes on the latter rarely ever being used, resulting in additional severe strains on the draft gear.

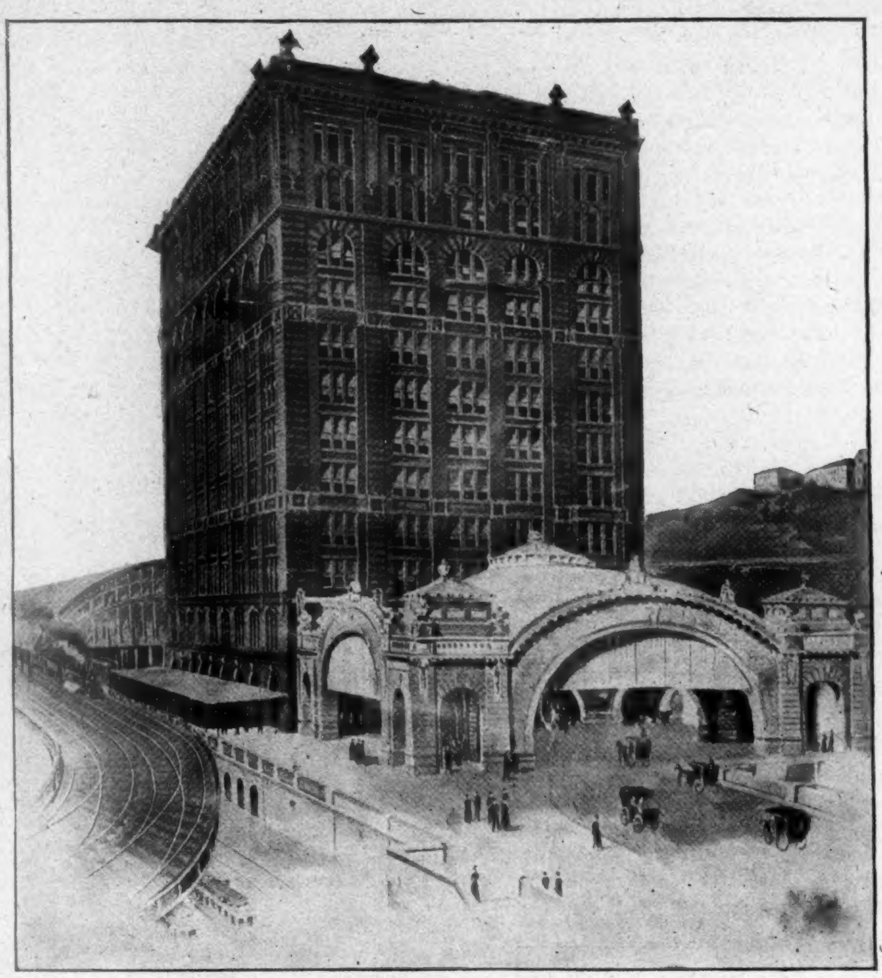
At each terminal the powerful switch engines employed work on heavy grades, enabling them to handle but few cars at a time, which causes a great deal of switching and an unusually severe service for the draft attachments. The use of heavy locomotives on steep grades, handling cars of large capacity—conditions which are rapidly becoming common on many roads—probably accounts for the inadequacy of the spring draft gear, although of the strongest type and greatest capacity, to protect the couplers from breaking. The record at the same time brings out very clearly the great value and really indispensable character of the friction draft gear under these conditions.

Fifty thousand dollars is the sum paid for the handsomest private car in this country. It was a gift to a wealthy Western brewer by the stockholders in his company, and as a surprise on his recent return from Europe.

NEW PENNSYLVANIA UNION PASSENGER STATION AT PITTSBURGH.

After the long periods of preparation and construction, the new Union Station of the Pennsylvania in Pittsburgh is sufficiently near completion for use, and it will soon be formally put into service.

This station is of brick, 352 by 175 ft. and 11 stories in height, with a large and imposing covered entrance with a domed roof and a large train shed in the rear. Accommodations for express, baggage, mail and the kitchens are provided on the lower floor, which is reached by depressed approaches from Grant and Liberty streets. The waiting room, restaurants, toilet and smoking rooms are on the train floor level, with high ceilings, offering an opportunity for exceedingly handsome decorations. Above these floors is the office building of ten stories, with accommodations for local offices and the general offices of the Pennsylvania Lines West of Pittsburgh. This colossal undertaking, including expensive track elevation, has been conducted throughout in a manner characteristic of this railroad and this is sufficient to convey the impression of a most satisfactory and handsome terminal. It is thoroughly worthy of the roads using it.

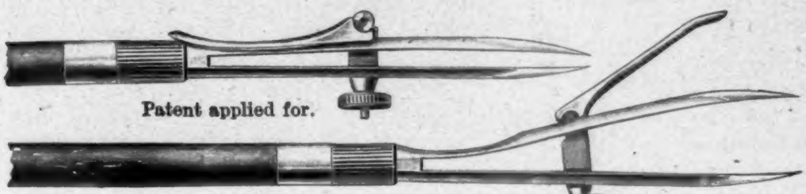


New Pennsylvania Union Passenger Station at Pittsburgh.

For heavy turntables the substitution of power for hand turning was recommended by a committee of the Association of Superintendents of Bridges and Buildings at their recent meeting. Electric power is preferred when it is available from near-by shops or where it may be conveniently purchased. Where electricity is not available gasoline engines are recommended. Steam power is not considered economical, though satisfactory in operation. The report on this subject presents figures showing the saving to range from $13 to $1.50 per day in favor of mechanical over hand power.

NEW PARAGON DRAWING PEN.

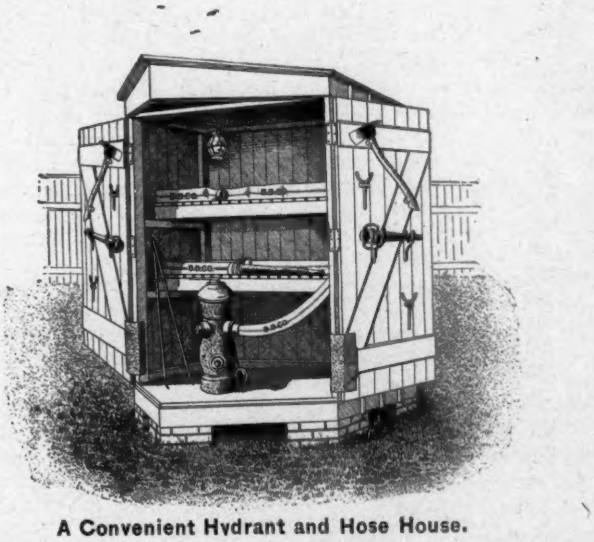
In addition to the excellent qualities which have brought the paragon pen into such general use, it now possesses an additional advantage in the way of opening the blades for cleaning, without altering its original setting. As will be noticed in the accompanying engraving, the blades are widely and instantly separated by a spring in the upper blade, when the excenter connected to the angular shank of the adjusting screw is released. On reapplying it the blades are brought to exactly their original position, smoothly and without jar. The adjusting screw is on the lower blade, permitting of changing the adjustment by applying one finger of the hand holding the instrument. These pens will be found a great convenience for all railroad draftsmen. They are made with ebony or aluminum handles, and may be obtained from Messrs. Keufel & Esser, 127 Fulton street, New York.



New Paragon Drawing Pen.

A CONVENIENT HYDRANT AND HOSE HOUSE.

The hydrant and hose house illustrated in the accompanying engraving is intended for use in shop and mill yards. Its many good features are apparent at a glance, and its details may, of course, be varied to suit various conditions. The design of the house and the arrangement of the doors provide for full and unobstructed access to and use of the hydrant and the hose. This construction is recommended by the Associated Factory Mutual Fire Insurance Company. Our engraving is taken from a catalogue on fire hose recently issued by the Boston Belting Company, 256 Devonshire street, Boston, Mass.

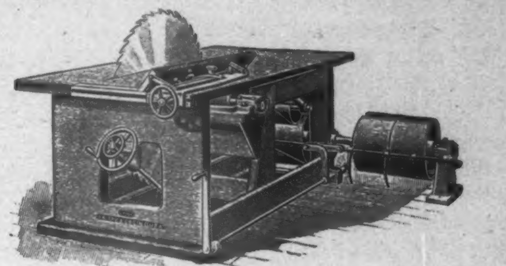


A Convenient Hydrant and Hose House.

The specifications for the Vanderbilt cars, which are illustrated elsewhere in this issue, are unusually complete. They include Dayton twin spring draft gear; Tower couplers; Peerless air hose; Westinghouse brakes; Vanderbilt arch bar trucks; Vanderbilt bolsters and hopper door rigging; McCord Journal boxes, and the cars are to be painted with Superior Graphite Paint furnished by the Detroit Graphite Manufacturing Company.

NEW RIP SAW FOR CAR SHOPS.

Special attention has been given in the design of the rip-saw shown in the accompanying engraving, adapting it to hard and heavy work in car shops. The frame of the machine is massive and substantial, and has a large table fitted with an adjustable fence on the front end, which can be tilted to any angle up to 45 degs. and moved to the right edge of the table, leaving a distance of 22 ins. between the saw and fence. The arbor, which is gibbed to heavy ways, carries a saw up to 42 ins. in diameter, and will rip material up to 15 ins. in thickness. The frame is raised and lowered by a hand-wheel and screw, with a lock attachment for holding it in position, which also insures uniform tension of the belt. The countershaft at the back of the machine is provided with a belt-shifting attachment, by which the machine can be started and stopped at the working end.



Heavy Rip Saw for Car Shops.

The J. A. Fay & Egan Company, makers of this machine, will furnish further information, and will also send free their large new poster, showing this machine and other car-shop tools.

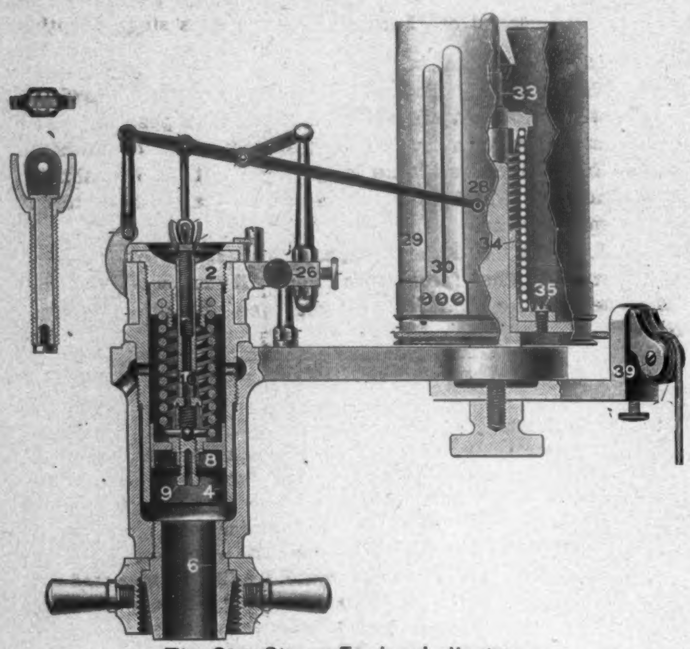
MECHANICAL DRAFT.

In the summary of advantages of mechanical draft presented in the treatise on that subject published by the B. F. Sturtevant Company, it is stated that "the very adaptability of mechanical draft is indicative of the fact that it is more flexible than that produced by the chimney, is more readily controlled and less influenced by climatic changes; while the apparatus for its production is more readily transported and has a higher potential value than a chimney. To a considerable extent these stand but as the conveniences of this method, regardless of their economies. When it is shown that increased efficiency can be secured by a method that is more convenient, the advantage of mechanical draft is established. The actual omission of the chimney is sometimes of far greater importance than would at first appear, while the readiness with which the rate of combustion may be increased is doubly appreciated when it is shown that under proper conditions the efficiency of combustion may be increased thereby. The purely economic features are presented most prominently in the ability to utilize low-grade fuels, the resultant economy being shown in numerous examples here presented. The economy in the quality of fuel consumed has, in its relation to the use of mechanical draft on shipboard, an advantage which is closely allied to that resulting from the decreased space occupied. The economic results which may be secured through the introduction of mechanical stokers and devices for utilizing the waste heat of the gases are rendered most evident under the conditions of mechanical draft production, as are also the great advantage of preventing smoke and the blessings of good ventilation as they are exemplified on shipboard. The facts that the size of a boiler plant required for a given output can be reduced when a fan is substituted for a chimney; that the cost of the mechanical draft plant is usually far less than that of the chimney draft plant, and that its operating expense is likewise less under proper conditions, all point most conclusively to the purely economic advantages of the method which it is the purpose of this book to present. When these are considered in the light of the convenience and various other advantages of mechanical draft, its evident superiority to chimney draft must be conclusively established in the mind of any one who has read these pages."

THE STAR STEAM ENGINE INDICATOR.

This name has been given to the indicator manufactured and sold by the Star Brass Manufacturing Company, of Boston, who have established a department to meet the demand for indicators.

It is similar to the Thompson indicator in appearance, and employs a pencil movement like that instrument. The lower end of the spring terminates in a ball, giving a ball and socket connection to the piston. A helical spring is used for the drum motion, and instead of a ratchet and pawl a new detent motion, employing a friction cluth, is used. This consists of a ball which is thrown into contact with a groove in the circumference of the drum base. The frame and coupling are of unusual strength, to secure rigidity where it is most needed. One of the improvements consists in the attachment of the cap at the top of the cylinder to the interior shell, within which the piston moves, rather than to the outer shell, thus securing and maintaining the most correct alignment for the motion of the piston and its rod. At the same time the interior shell



The Star Steam Engine Indicator.

is removable, as in instruments which do not possess this feature. A jacket space, filled with working steam, completely surrounds the lower part of the interior shell and secures a uniform temperature on the inside and outside of the cylinder, which insures immunity from unequal expansion.

A noticeable feature is the means for unscrewing and removing the cap from the cylinder with the parts attached to it. The cap has a milled edge of the usual construction, but the edge is protected by a hard rubber non-conducting covering. This covering can be handled with comfort to the one using it, whereas in the indicators heretofore made, as everyone who has operated an indicator knows, it is impossible to unscrew the cap without risk of burning the thumb and finger with the hot metal. Another thing which will be appreciated by those having the active handling of the instrument, is the provision of a vent tube for carrying away the waste steam and hot water which blows by the piston. This tube is attached to the side of the cylinder and it extends a sufficient distance below the body of the instrument to fully clear it, and prevent the hot water which is mixed with the steam from dripping on the hand of the operator while in the act of turning off the indicator cock.

The piston rod of this indicator is provided with an adjustible swivel-head, so planned that the position of the pencil arm can be varied and the atmospheric line drawn at any desired distance from the lower edge of the card, without going to the trouble of removing the piston and its mechanism from the cylinder. It is simply necessary to screw the swivel-head up or down the desired amount, using the thumb and finger.

The address of the Star Brass Manufacturing Company is 108 East Dedham street, Boston.

BOOKS AND PAMPHLETS.

Universal Directory of Railway Officials. Compiled from official sources under the direction of S. Richardson Blundstone, Editor of the Railway Engineer. Published by the Directory Publishing Company, Ltd., London, 1901. E. A. Simmons, United States Representative, 697 Chauncy street, Brooklyn, N. Y. Seventh edition, 623 pages, bound in cloth. Price, $2.50.

This directory is a necessity in every railroad office that has to do with foreign railroads. It contains a list of the railroads of the entire world, together with their mileage, gauge, equipment and officials, also a personal index of the railroad officials. This seventh annual edition has been carefully revised and brought up to date. It is somewhat enlarged, 60 pages in all having been added to the directory.

Linear Drawing and Lettering. By J. C. L. Fish, Associate Member A. S. M. E., Associate Professor of Civil Engineering in Leland Stanford, Junior, University. Published by the author. Palo Alto, California. 65 pages, 7 by 10½ ins., bound in cloth. Price $1.00 post paid. 1901.

The aim of this book is to give the student enough training in the use of drafting instruments to enable him to construct accurate pencil drawings, make clean-cut lines and do legible lettering. Chapter I. treats of the care and use of materials. The work given in chapters II. and III. constitutes a course of 50 working hours in lineal drawing and lettering, while Chapter IV. is an introduction to drafting. Reference is made throughout the last three chapters to 50 figures which are put in the form of folded plates in the back of the book. In connection with this course of lettering the author has issued a separate blank book of specially ruled paper.

A Hand-Book for Apprenticed Machinists. Edited by Oscar J. Beale. Second edition, 141 pages, with index, bound in cloth. Published by Brown & Sharp Manufacturing Co., 1901. Price, 50 cents.

This little hand-book gives information that every young apprentice, who is serving his time at the machinists' trade, should possess. The first edition was published about two years ago by the Brown & Sharp people for the apprentices in their own shops, but there has been an increasing demand from outside for this volume, so that in this second edition enough copies were printed so that they could be placed on the market. The work does not go into mathematical details, but is comprised of hints in the care of machine tools and explanation of terms pertaining to screw threads; instruction in the figuring of gear and pulley speeds, as well as the figuring of change gears in screw cutting. Also chapters on such subjects as centering and care of centers; turning, reading a drawing, measuring and lacing a belt; signs and formulas; drilling, counter-boring, tapping and cutting speed; the screw and its parts; angles, setting a protractor and working to an angle; circular and straight line indexing, and the subdividing of threads. Copies of this hand-book can be procured from the various book dealers, or will be mailed direct from the Brown & Sharp Manufacturing Co., Providence, R. I.

Poor's Manual for 1901 has issued its advance copies of the introduction, giving a general exhibit of the railroads of the United States for the fiscal year 1900. The length of railroads completed on December 31, 1900, was 194,321.09 miles, of which 188,334 miles are represented in the returns to this valuable publication. After presenting summaries of traffic, capitalization, construction statements, in groups of States and statistics of the trunk line railways, the report presents a comparative statement of the leading trunk lines covering 60 roads, of which is said: "By this statement it appears that the 60 systems whose operations it covers controlled, in 1900, 62.8 per cent. of all the railroads in operation in the country. In other respects it shows that of the passengers carried in 1900 (584,695,935) these 60 systems carried 442,382,459, or 75.6 per cent. of the whole number, the total distance traveled by passengers on the 60 systems being 12,936,472,872 miles at an average charge of 1.993 cents per passenger per mile, against a general average for all

the roads in the Union of 2.031 cents. Of freight tonnage the companies included in the table hauled 685,908,701 tons, being 64 per cent. of the total tonnage (1,071,431,919) of all the lines in the country. Their aggregate haulage equaled 111,419,695,803 tons one mile, being 79 per cent. of the grand total, while the average charge per ton per mile was 0.713 cent, or 0.033 cent less than the general average for the whole country."

A Solid Wrought Steel Passenger Truck.—The J. G. Brill Company of Philadelphia have issued a pamphlet dated October, 1901, which is the 6th edition of their catalogue No. 80, devoted to their truck No. 27, which has been repeatedly referred to in our columns. This truck has seen six years of service and is now working satisfactorily under a great variety of conditions. It has three sets of springs, in series, all of which operate through swinging links. Changes in detail have been made, the most important being solid forged wheel pieces instead of cast steel formerly used. The pamphlet describes the truck and explains the features of its suspension. It also contains a large number of letters from those who are using these trucks; these represent a large variety of service.

Electric Motors, Generators and Generating Sets.—The B. F. Sturtevant Company, of Boston, Mass., has in the past ten years developed the electrical side of their business to a magnitude correspondingly as great as their blower department. This is evidenced in their new catalogue No. 117, which presents a large number of the standard products of their electrical department, such as 2, 4 and 8-pole motors and generators and generating sets. These are illustrated and briefly described in the pamphlet, together with sizes and tables of dimensions. The B. F. Sturtevant Company are fully equipped to meet any requirements in the way of moderate sizes of these electrical machines.

Hydraulic Jacks.—This catalogue, No. 61, just issued by the Watson-Stillman Company, is one of a large number of individual catalogues of high-grade hydraulic tools manufactured by this company for all purposes. It is devoted to both horizontal and vertical jacks, also lifting tools, and contains a general description of the construction of their improved jacks. This company carries in stock, in the form of separate sheets, printed information on all their standard hydraulic tools. These single sheets are sent out in assortments as demanded by the trade. The address of the Watson-Stillman Company is 204 East Forty-third street, New York.

EQUIPMENT AND MANUFACTURING NOTES.

A gold medal has been awarded The Continental Iron Works, of New York, Borough of Brooklyn, for the Morison suspension boiler furnaces exhibited at the Pan-American Exposition. These furnaces are in great favor for land and marine boilers. Their form of construction offers the greatest possible resistance to distortion or collapse, and a freedom from leakage not to be obtained in furnaces which consist of sectional flanged and riveted cylinders, with reinforcing rings interposed between the flanges, or any other method. The Continental Iron Works are the sole manufacturers in this country for the Morison suspension furnaces.

The Lunkenheimer Company has received recognition from the Pan-American Commissioners for the high character of their valves, lubricators and engine fittings, in the form of a gold medal.

The "Diamond S" and other brake shoes made by the American Brake Shoe Company were well represented at the recent street railway convention in an exhibit which was in charge of Mr. F. W. Sargent, Chief Engineer of the company. These shoes are well known to our readers for their peculiar construction, and use of material which combines high friction qualities with durability as far as these qualities can be combined. In our August issue of the current volume, page 257, a statement of the purposes of the various brake shoes made by this company was presented. Associated with Mr. Sargent in connection with the exhibit were Mr. O. H. Cutler, General Manager of the Ramapo Foundry Company, and also Messrs. Arthur Gemunder and W. W. Gardner.

The prompt action taken by the Chicago Pneumatic Tool Company to protect its customers from litigation and further expense in the matter of the Moffet patent No. 369,120 on portable drilling machines, which was decided in favor of the Moffet patent, by the United States Circuit Court, will no doubt be appreciated. After consultation with leading patent attorneys and a careful examination, the Chicago Pneumatic Tool Company has become convinced that the portable power drills made by itself, as well as by all other concerns, are infringements on the Moffet patent. In view of the decision this company has purchased a license under this patent, which protects all drills that have been manufactured and sold by them or shall hereafter be manufactured or sold.

A prominent railroad of this country after testing the Ajax Plastic Bronze to the extent of 13,400 brasses on cars of 100,000 lbs. capacity, made the statement that that road "has not had a train delayed on account of hot brasses since adopting Ajax Plastic Bronze." The Ajax Metal Company, of Philadelphia, has no hesitancy in saying that their plastic bronze will show a saving of 50 to 100 per cent. in mileage, and are prepared and have the privilege of furnishing the name of this road to any motive power department desiring full information.

The exhibit of the Corning Brake Shoe Company at the American Street Railway Convention, held in New York last month, consisted of an interesting collection of different types of their brake shoes for all service. Some of these shoes were the standards used by many of the electric and steam railways in New York. This shoe is one that does not cut the tire, and has a coefficient of friction that fulfills the requirements of steam and electric railway service. They are made of soft cast iron and chilled iron, which gives the shoe a uniform action. They are long lived, the cost is low in consideration of their long life, and they have ample strength to prevent breakage in service. The general office and works of the Corning Brake Shoe Company are at Corning, N. Y.

The contract for the electrical equipment of the main power house and sub-stations of the Rapid Transit Railroad of New York City was awarded, October 4, by John B. McDonald to the Westinghouse Electric & Manufacturing Company. Although the value was not made public, it is understood that at least $1,500,000 will be expended on the equipments. Among the apparatus provided for in the contract are six 5,000-kilowatt alternators, three 250-kilowatt exciters, twenty-six 1,500-kilowatt rotary converters, seventy-eight 550-kilowatt transformers, and eight motor-generator starting sets. The third-rail system has been definitely adopted as the motor principle for the underground road. The steam plant will consist of twelve 7,500 to 11,000-horse-power engines, each of which will drive a 5,000-kilowatt generator.

A very interesting and characteristic exhibit of the Hale & Kilburn Manufacturing Company, of Philadelphia, was displayed at the recent Convention of the American Street Railway Association at Madison Square Garden, New York. One of the sections of the south gallery was fitted up in a novel way to represent a room, the walls of which were hung with canvas-lined rattan. The furnishings of the room were various styles of car seats manufactured by this company, together with different kinds of material, such as mohair plush and samples of rattan, used in upholstering work. Considerable interest was shown by railroad men in the walkover car seat, which occupied a prominent position in the exhibit. This seat is of pressed steel construction, with the number of parts reduced to a minimum. It gives 2 ins. greater seating capacity and the cushion and back are detachable. A patent oval base and single automatic shifting footrest is used in connection with the seat, which gives an entirely clear space under the seat for baggage, and greatly facilitates floor cleaning.

The fall term of Purdue University opened September 12, with a freshman class of something over 300. By the close of the first week 1,000 students were in attendance, indicating that the total enrollment for the year will exceed 1,200. Of those already enrolled 766 are taking engineering courses, and 300 are in the course of mechanical engineering. The special work of this course in locomotive and car design, inaugurated this year under the direction of Professor William Forsyth, is giving promise of flattering success.

Among the prominent firms to receive a gold medal at the Pan-American Exposition is the American Steam Gauge & Valve Manufacturing Company, the well-known manufacturers of steam specialties. Visitors at the exposition will remember their exhibit, which attracted a great deal of attention, and particularly their steam gauges and engine fittings, which won for them this medal. This company reports a continually increasing business both domestic and foreign, with capacity for dealing with all orders promptly.

The Continuous Rail Joint Company of America was well represented at the recent Annual Meeting of the American Street Railway Association, in New York. Their exhibit, which was a very interesting one, was located on the main floor of the convention hall. The continuous rail joint (which is now used on about 140 roads and applied to over 10,000 miles of track in the United States) was shown in connection with a variety of sections of T and girder rails. The base plate of this rail joint is an integral part of the joint and gives great horizontal and vertical rigidity, prevents the rail from being battered and makes the joint as strong as any part of the rail.

The Russell Snow-Plow Company, of Boston, has received orders for their snow-plows from various railroad companies, as follows: New York Central and Hudson River Railroad, two Russell double-track wing-elevator snow-plows, size No. 2; two Russell standard double-track snow-plows, size No. 2, also three Russell single-track wing-elevator snow-plows, size No. 2. Each of the above plows to be equipped with Russell air flanger, the Westinghouse air-brake and train signal, and with Gould automatic coupler. Central Railroad of New Jersey, one Russell standard double-track snow-plow, size No. 2, equipped with Westinghouse air-brake and air signal. New York, Chicago & St. Louis Railroad Company, one Russell standard single-track snow-plow, size No. 2, equipped with Russell air flanger, Westinghouse air-brake and air signal. Somerset Railway Company, one Russell standard single-track snow-plow, size No. 3. Delaware & Hudson Company, one Russell standard single-track snow-plow, size No. 2. Bangor & Aroostook Railroad Company, five Russell single-track snow-plows, size No. 2, equipped with Westinghouse train air signal. Lake Shore & Michigan Southern Railway Company, two Russell standard double-track snow-plows, size No. 4, equipped with Russell air flanger, Westinghouse air-brake and signal, and Gould automatic coupler. Grand Rapids & Indiana Railway Company, one Russell single-track wing-elevator snow-plow, size No. 2. Buffalo, Attica & Arcade Railroad Co., one Russell single-track snow-plow, "Flyer A." All of the above snow-plows will be built by the American Car and Foundry Company, many of which are now under construction.

One of the largest and most interesting exhibits at the American Street Railway Convention, held in New York, October 9 to 12, was that of the Westinghouse Electric and Manufacturing Company. Nearly one-half of the central portion of the main floor was devoted to various sizes of standard railway motors; Brill maximum traction truck, equipped with Westinghouse No. 81 railway motor; Peckham truck, equipped with two No. 49 Westinghouse railway motors; railway power station switchboards; ammeters and voltmeters, lightning arresters, switches, circuit breakers, and all switchboard instruments, together with a Brill double-truck closed car, equipped with the Westinghouse magnetic brake and car-heating apparatus. The car was in actual operation on a section of inclined track in the center of the hall. The heaters are connected with the general system of wiring by means of a suitably arranged switch, so constructed that the braking and starting currents, both of which are used for heating the car in cold weather, may be divided as desired, and the whole or any portion sent through the heaters. An important advantage of this heater is its capacity to store and retain heat within its mass. The brake consists of a double shoe, combined with a powerful electro-magnet, which, when energized, is strongly attracted to the rail. This shoe, combined with brake heads, and shoes of the ordinary type acting directly on the wheels, constitutes a wheel brake of maximum power and efficiency. The brake operates independently of the trolley current.

Keuffel & Esser Company, of New York, have been awarded a gold medal at the Pan-American Exposition for their drawing materials, mathematical and surveying instruments, the gold medal being the only one awarded in this line of manufactures.

Mr. Walter W. Davin, of Chicago, who has long been identified with, and is widely known, in connection with steam specialties, has been secured by the Shields Flexible Joints Company to take charge of their railroad interests. His headquarters are at 906 Fisher Building, Chicago. His wide acquaintance and thorough knowledge of steam specialties, as well as of the requirements of the railroad, assure the success of this department.

The Safety Car Heating and Lighting Company has been awarded a gold medal by the Pan-American Commissioners for their "Pintsch light." The company has recently put into operation plants at St. Paul, Minn., and Los Angeles, Cal., and are building new ones at El Paso and San Antonio, Tex.; Shreveport, La.; Mexico City, Mex., and Moncton, New Brunswick.

Considerable interest was shown on the part of electric and steam railroad men in the very extensive exhibit of new designs of Brill cars and trucks at the Twentieth Annual Convention of the American Street Railway Association, held last month in New York. The novel features of the new Brill convertible and semi-convertible car were shown to good advantage by full-sized sections and models. The chief object of this type of car is to have a satisfactory closed car in winter, and one that can readily be converted into an open car for summer use by the removal of the windows and sash. The side panels are made flexible, to follow the sash and glass into the roof. The posts have precisely the same external form as those of standard open and closed cars. Aside from the convertible feature of the car it is particularly noteworthy on account of its lightness and strength. Another of the Brill cars which attracted considerable attention by the visitors was the Narragansett type, which gets its name from being the first of this kind of car built for the Narragansett Pier Line. The chief features of the car aside from the design of the side sills, which are Z-shape, formed from two angle irons, the vertical side of one forming the sill proper, is that the trucks are available for use under both open and closed cars. This type of car seems to have met with considerable favor in the short time it has been on the market, as several large orders have already been placed for them.

Maine offers scenes and pleasures in the line of fishing and hunting that are all her own, and in the chase for big game she has no competitors. Deer are not only more numerous, but they grow to a much larger size, and the person who knows how to handle a gun at all is reasonably sure of his full quota of deer and moose. Although these two kinds of game are usually enough to satisfy the appetite of the average sportsman, they are by no means the only kinds of game to be found in these vast timberlands. Braces of smaller game, together with a plentiful supply of partridge and quail, have already been brought into camp in that section which lies contiguous to the Dead River and known as the Rangeley region. Bears are much more plentiful this year than ever before, and to the sportsman who enjoys this exciting sport, this portion of Maine is an especially desirable spot. The only railroad out of New England that makes direct connections for the heart of the hunting and fishing regions is the Boston & Maine. This road publishes a book called "Hunting and Fishing," that pictures these very desirable places and tells how to reach them. The pamphlet will be mailed to those sending a two-cent stamp to the General Passenger Department of the Boston & Maine, at Boston, Mass.